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Research Article

Substance Abuse, A Public Health Challenge: Study From Jizan City, Saudi Arabia

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ABSTRACT

Poor knowledge could be a precursor to substance abuse among adolescents. Prior to program development, it is necessary to know about the knowledge, attitude and perceptions about drug abuse in this population. The objective of this study was to explore the knowledge, attitude, perceived consequences of substance abuse among secondary school students in Jizan city, Kingdom of Saudi Arabia. This descriptive study included a representative sample of male secondary school students. A multistage random sample was generated. A self administered validated and reliable Arabic questionnaire was used. Knowledge scores were computed such that correct answer was given a score of 1 while incorrect and unknown answers were given a score of zero. The percentage of correct answers was computed for the sample. Mean percentage of knowledge score >60% was considered sufficient knowledge while ≤60% was considered insufficient knowledge.

Out of 1100 male secondary students invited to participate in the study, 1022 returned filled questionnaire giving a response rate of 92.9%. Their age ranged between 15 and 19 years with a mean of 17.33 and standard deviation of 0.98 years. The great majority of them (99.7%) have heard about substance abuse and 83.8% claimed that they have information about different abused substances. Their sources of information about substance abuse were internet (71.1%), TV/Radio (61%), friends (55.5%), schools (43.9%), family members (33.8%) and finally newspapers and magazines (31.2%).Most of male students in Jizan had sufficient knowledge regarding substance abuse.

KEY WORDS: adolescents, attitudes, knowledge, substance abuse

INTRODUCTION:

Substance abuse is one of the epidemic diseases, the effects of which are not limited to the individual but extend to his or her family and society at large. It is a critical issue in most societies and is associated with social and economic consequences.[1] Drug-related problems cause huge waste of resources, both human and financial.[2] There is a substantial risk for initiating substance use during adolescence as it is a transitional stage of physical and mental human development. Adolescents are cognitively immature and vulnerable to social influences, thus experimentation with addictive substances often begins in this age. Several studies in adolescent population have reported positive association between knowledge about substance abuse and their attitudes toward substances.[3,4]

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There is a diagnostic dilemma for this public health issue in Islamic countries as alcohol and drug abuse are categorically forbidden by Islam. Addictive behaviours are socially stigmatizing and tend to be concealed by the individual involved. This might interfere with the representativeness of the population screening methods, and consequently the reported incidence rates of substance abuse in Islamic countries. However, there is now enough evidence from recent (though few) studies to alert Arab/Moslem communities to the realities and the magnitude of the drug problem. There is also evidence, though scanty, that drug abuse is more common in the Saudi community than was previously thought, as reported in two similar studies. [5,6] Extensive mass media campaign and the establishment of specialized drug abuse centers (Al-Amal Hospitals) all over the country are further evidence of the urgency of the problem [(1)].

For effective redressal of this public health problem in future and to ensure the success of any preventive or behavioural modification programmes, it is imperative to have an understanding of current

Frequencies, percentages, mean and standard deviation (SD) were used as descriptive statistics.

RESULTS:

Table 1 presents the personal characteristics of the students. Their age ranged between 15 and 19 years with a mean of 17.33 and standard deviation of 0.98 years. Total number of siblings was more than 6 among 59.8% of the participants. Exactly half of the students reported from 2nd to 4th birth order while 15.9% reported first birth order. Almost a quarter (24.8%) of students reported that their fathers had no formal education and 40.3% of them reported that their mothers had no formal education. The fathers of one-fifth (20%) of the students were working as teachers while 29.5% were military persons. The majority of students` mothers (88.3%) were house wives. Approximately half of the students (51.9%) had a family income ranged between 5000 and 10000 SR/month whereas 20.6% of them had family income more than 10000 SR/month. Majority of the students (90.7%) were residing in private houses and (91.4%) had parents living together.

Figure 1illustrates that majority of male secondary school students in Jizan (99.7%) reported having heard about substance abuse and 83.8% of them claimed that they have information about different abused substances while 92% perceived substance misuse as a problem among adolescents in Jizan.

Figure 1: Awareness and opinion regarding substance abuse among respondents.

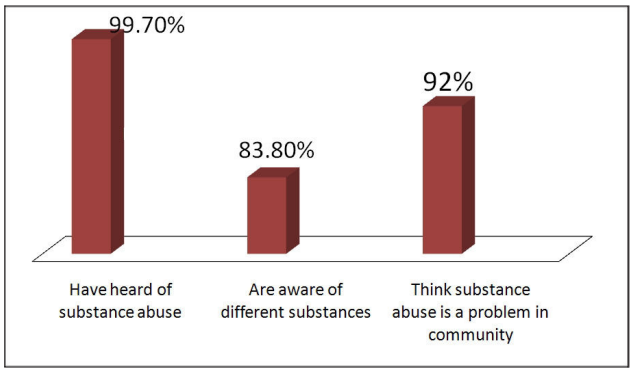

Table 2 illustrates the student`s knowledge of health, social and economic consequences of substance abuse. As regards the individual statements pertaining to the consequences of substance abuse, majority of students (91.8%) disagreed with the statement that nothing happened to the health of substance abusers and 80.1% of them agreed that substance abuser always has unsatisfactory health. In addition, 81.2% and 83.1% of them agreed that substance abuser develops respiratory and heart diseases, respectively.

Majority of students agreed that substance abuser spends money for nothing (94.6%), finally drops out of school (86.7%), gets sacked from employment because of irresponsibility (91.4%), always runs short of money (93%), against the norms of society (89.4%) and considered as a burden to society (90.9%). Similarly, majority of students agreed that family of a substance abuser as head always experiences poverty (87.5%), he/she and his/her family is looked down by others (88%) and people would not like the company of substance abusers (89.3%) and would not confide them (92.2%). The knowledge score regarding substance abuse among respondents ranged between 12.5% and 95.83% with a mean of 72.65% and standard deviation17.16%. Overall, 842(82.4%) students demonstrated sufficient knowledge (a score of 60% or more).

Most of the students believed that occasional as well as frequent use of cigarettes, alcohol and illicit drug use were extremely harmful. Table 3 lists the reported sources of information about substance abuse as internet (71.1%), TV/Radio (61%), friends (55.5%), schools (43.9%), family members (33.8%) and newspapers and magazines (31.2%).

DISCUSSION:

The results of the current study point out that male secondary schools students in Jizan, KSA have a basic understanding of the nature of substance abuse. Subjects were also knowledgeable about the health, socioeconomic, and socio-cultural implications of substance abuse.

On one hand, this knowledge might reflect improved access to the mass media (i.e., Internet, satellite TV channels), resulting from improvement in the economic status. On the other hand, others assert that knowledge of substance abuse among adolescents may reflect their exposure to drug use within their peer group.[9] This is also suggested by the finding that a vast majority of students believed that drug abuse was an existent problem in their community. Researchers in related studies have found similar results, which show a high percentage of adolescents reflect good knowledge on substance abuse.[8,10,11]

Regarding the effects of cigarette and alcohol use, a few students believe that occasional as well as frequent use does not have harmful effect. These are disturbing findings which have been replicated in

prevailing behaviours, attitudes and beliefs about substance abuse among the adolescents. This important area of drug abuse research is grossly lacking in spite of the increasing prevalence of substance abuse in the Saudi Kingdom. Current study aims to address this issue of knowledge, attitudes and perceived consequences of drug abuse among adolescent students in southern Saudi Arabia.

MATERIALS AND METHODS:

This is a cross sectional, descriptive study of male secondary school students in Jizan, Saudi Arabia, conducted between June 2013-June 2014. All the necessary official permissions were fully secured before data collection. The study was proposed to the ethical committee of King Khalid University, and permission was obtained. A letter of approval was obtained from the Director of Jizan Educational Affairs to the headmasters of each of the ten chosen schools and official access to students was gained. A multistage, random sampling technique was used to generate a sample size of 1100. Ten schools were randomly selected by lottery method. After that, three individual classes of students were selected from each school .All students in the selected classes were invited to participate in the study until the sample size of 1100 was reached. In the selected school, the questionnaires were distributed to all chosen students.
A self-administered questionnaire designed was used to collect data on knowledge, attitudes and beliefs regarding substance abuse. This questionnaire was originally developed in 2002 by National Agency for the Treatment and Rehabilitation of Substance Abusers in Bangladesh to survey young people (aged 12-24 years) regarding substance use.[7] The Arabic version was developed for use in a Jordanian study [8] .The instrument was translated into Arabic using a comprehensive method to ensure equivalence and validity. It consisted of the following sections: a) background information of the respondents; b) knowledge about substance abuse, and its associated health, economic, and socio-cultural consequences and c) sources of information. Knowledge score was computed in the way that correct answer was given a score of 1 while incorrect and unknown answers was given a score of zero. The percentage of correct answers was computed. Mean percentage of knowledge score >60% was considered sufficient knowledge while ≤ 60% was considered insufficient knowledge.

Statistical Package for Social Sciences (SPSS version 18.0) was used for data entry and analysis.

Table 1.Sociodemographic characteristics of respondents

Variable	No.	%
Age in years		
15	49	4.8
16	124	12.1
17	398	38.9
18	347	34.0
19	104	10.2
Total number of siblings		
1-3	92	9.0
4-6	319	31.2
>6	611	59.8
Birth order		
1st	162	15.9
2nd-4th	512	50.0
>4th	348	34.1
Father`s education		
Illiterate	253	24.8
Primary school	173	16.9
Intermediate school	143	14.0
Secondary school	217	21.2
University	198	19.4
Postgraduate	38	3.7
Mother`s education		
Illiterate	413	40.3
Primary school	246	24.1
Intermediate school	183	17.9
Secondary school	98	9.6
University	61	6.0
Postgraduate	21	2.1
Father`s occupation		
Not working	104	10.2
Teacher	204	20.0
Military	303	29.5
Employee	110	10.8
Business/trading	52	5.1
Retired	146	14.3
Farmer	47	4.6
Others	56	5.5
Mother`s occupation		
Not working	902	88.3
working	120	11.7
Family income (SR/month)		
<5000	281	27.5
5000-10000	530	51.9
>10000	211	20.6
Residence		
Rent	95	9.3
Private	927	90.7
Parental marital status		
Living together	934	91.4
Separated/divorced	33	3.2
One /both died	55	5.4

Table 2 : Respondent's perceptions regarding health, social and economic consequences of substance abuse.

Substance abuse related statement	Student opinion		
	Agree	Disagree	Don't know
Nothing happens to the health of a substance abuser.	46 (4.5)	938 (91.8)	38 (3.7)
A substance abuser always has unsatisfactory health.	819 (80.1)	88 (8.6)	115 (11.3)
A substance abuser develops respiratory diseases.	830 (81.2)	57 (5.6)	135 13.2)
A substance abuser develops heart diseases.	849 (83.1)	39 (3.8)	134 (13.1)
A substance abuser spends money for nothing else .	967 (94.6)	37 (3.6)	18 (1.8)
A substance abuser finally drops out of school.	886 (86.7)	62 (6.1)	74 (7.2)
A substance abuser always runs short of money.	951 (93.0)	9 (0.9)	62 (6.1)
A substance abuser gets sacked from employment because of irresponsibility.	934 (91.4)	37 (3.6)	51 (5.0)
The family of a substance abuser as head always experiences poverty.	894 (87.5)	32 (3.1)	96 (9.4)
Substance abuse is against the norms of society.	914 (89.4)	47 (4.6)	61 (6.0)
The substance abuser and his family is looked down by others.	900 (88.0)	15 (1.5)	107 (10.5)
People do not like the company of substance abusers.	913 (89.3)	43 (4.2)	66 (6.5)
Substance abusers are considered as a burden to society.	929 (90.9)	37 (3.6)	56 (5.5)
People do not confide in substance abusers	942 (92.2	23 (2.3)	57 (5.5)

Table 3: Sources of information regarding substance abuse.

Source of information	No. (%)
Friends	567 (55.5)
Family	345 (33.8)
Tv/Radio	623 (61)
Internet	727 (71.1)
Newspapers/magazines	319 (31.2)
School	449 (43.9)

surveys in Philippines [12] where students believed that psychoactive use entailed no or slight risk , and in South Africa where youth approval of cigarette use and drinking was high. Also, disapproval was high only for using heroin and mandrax in Tanzania.[13]

An important finding of this study is that a negative image of the drug addict in the society is well established in the mind of the participants. Any preventive campaign can take advantage of this fact and strengthen this image to discourage future abusers. This finding however, also has a negative side as negative attitudes, particularly if expressed through negative or prejudiced behavior, may further alienate a social group that is already socially marginalized. This in turn may prevent such group members from seeking the help they require.[14]

Similar was found in Bangladesh where participants appeared to be socially conscious in their attitude towards substance/drug abuse .Majority of them were aware of the harmful effects of substance/drug abuse on society and human body as well as negative image of addicts in society, linked substance/drug abuse to disturbed family peace, and cited it to be responsible for poor academic performance.[7]

Mass media emerges as the major source of Information which is similar to findings from Bangladesh, India and Africa.[7,10,15] However, it is to be noted that internet has surpassed TV as the major source of information when compared to past studies.

The findings of this study provide the basis for developing comprehensive prevention programs that are directed to adolescents. These school-based educational programs should include information concerning addiction and forms of treatment as well as appropriate treatment services. School and public health programs must address the importance of smoking cessation and the addictive nature of nicotine as a gateway substance.

CONCLUSION:

There is a fair amount of general knowledge regarding substance abuse among the adolescents. They also believe that substance abuse is a problem in their community. These findings can be utilized for developing comprehensive prevention programs targeted to adolescents. These educational programs can be school based and should include information concerning addiction and forms of treatment as well as appropriate treatment services. School and public health programs must address the importance of smoking cessation and the addictive nature of nicotine as a gateway substance for drug abuse.

STRENGTH AND LIMITATIONS:

The study used a validated Arabic questionnaire and was the first of its kind study in the southern part of Saudi Arabia. Also a large sample of students was studied. However, as Saudi Arabia is a vast country, the study findings cannot be generalized. More such studies are recommended.

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Research Article

Intranasal Midazolam Versus Intravenous Diazepam for the Treatment of Acute Seizures in Paediatric Patients

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ABSTRACT

The objective of this study was to measure the time needed to control seizure attacks using intranasal midazolam compared with intravenous diazepam and to evaluate the probable side effects. This study was conducted as a non blind randomized clinical trial among 50 patients coming to MLBMC, Jhansi. The patients were 2 months to 15 years old children coming to our emergency department suffering from an acute seizure episode. Intranasal midazolam was administered 0.2 mg/kg equally dropped in both nostrils for group A and intravenous diazepam was administered 0.3mg/kg via intravenous line for group B. Choice of drugs for patient was based on randomization. After both treatments, the time needed to control the seizure was registered by the practitioner. Pulse rate and oxygen saturation were recorded at patient's entrance and in minutes 5 and 10 after drug administration. The mean time from physician contact to cessation of seizures was significantly shorter in the midazolam group (3.9880(SD 1.38784) minutes), than the diazepam group (5.4840 (SD 2.33661)min). The mean time from drug administration to cessation of seizures was significantly sooner (3.1160 (SD 0.97112)min) in the diazepam group than the midazolam group (3.8720 (SD 1.57229) min). No significant side effects were observed in either group. Seizures were controlled more quickly with intravenous diazepam than with intranasal midazolam, although midazolam was as safe and effective as diazepam. The overall time to cessation of seizures after arrival at hospital was faster with intranasal midazolam than with intravenous diazepam due to its shorter time of adminstration.

KEY WORDS: diazepam, intranasal, intravenous, midazolam, seizures

INTRODUCTION:

A seizure is a transient symptom of abnormal, excessive or synchronous neuronal activity in the brain. Approximately 4-10% of children experience at least 1 seizure in the first 16 year of life. The cumulative lifetime incidence of epilepsy is 3%, and more than half of the cases start in childhood[1]. It constitutes about 70% of paediatric neurological disorders. It is a life threatening event and longer duration is associated with higher mortality and morbidity. Focus of management is to stabilize the patient, quickly terminate the seizure activity, identify and treat life threatening conditions and to initiate follow up.

Till date, short acting anticonvulsants like benzodiazepines have mainly been used to control seizures. Benzodiazepines cross the blood brain barrier promptly and achieve peak CSF concentration within minutes of administration. Conventionally short acting benzodiazepines (Diazepam, Midazolam, IBZD) are given by parental routes (IV or IM) for acute management of seizures.[2]However, intravenous (IV) line is difficult to establish in a convulsing child and requires expertise. Intramuscular (IM) route cannot be relied upon as it has erratic absorption and delayed CNS effects[3]. Thus various alternative routes of administration are under evaluation. Currently emphasis is being laid not only to control an acute episode in hospital setting but also for management of seizures at home. Various alternative routes of administration are intranasal, rectal, sublingual and buccal. Buccal and sublingual routes are difficult because of frothing and clenching associated with seizures.[4] Rectal route is socially less acceptable especially in adolescent.[5] Therefore, intranasal (IN) route may be a preferred route as it is more convenient for drug administration. Midazolam is a watersoluble triazole- benzodiazepine. It has imidizole ring

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different from other benzodiazepines. At a pH less than 4 it is water soluble, but at physiological pH it is highly lipophilic which accounts for its rapid absorption, shorter duration of action and rapid clearance[2], thereby making it ideal for intranasal administration.

The vascular nasal mucosa facilitates rapid absorption, a fact known by cocaine addicts for years, and drugs administered this way have been utilized in a variety of treatment methods.[6] The ease of intranasal midazolam administration to treat episodes of seizure makes it a good candidate to replace the conventional treatment methods not only for use at home but also for health professionals.[7]

The nasal mucosa provides a large (180 cm^2), highly vascular absorptive surface adjacent to the brain. Together with the neighbouring olfactory mucosa, it offers a direct pathway for drug absorption into the bloodstream & CSF. Therefore, the nasal route is a good option for drugs that undergo extensive hepatic metabolism increasing their bioavailability and drugs with erratic absorption patterns. It is also advantageous when drugs with a short latency of action, such as benzodiazepines are required.[8]

When venous access is challenging or cannot be obtained, the most common alternatives have been rectal diazepam and intranasal midazolam, with some studies suggesting intramuscular midazolam as an additional option. The difficulty of administering BZDs rectally or intranasally and the erratic absorption provided by these routes jeopardize anticonvulsant efficacy. Thus far, no consensus has been established as to the best route for administration of BZDs in the event of failed intravenous access.

Hence this study was conducted to compare the therapeutic efficacy of intranasal midazolam (IN MDZ) with that of intravenous diazepam (IV DZP) in children admitted to the referral service of a pediatric emergency department with epileptic seizures.

MATERIALS AND METHODS:

A prospective randomized study was conducted on 50 subjects over a period of 15 months in the Department of Pediatrics, MLB Medical College, Jhansi. All patients between the age of 2 months to 15 years arriving in emergency in a convulsing state were the subjects of this study. Strict ethical considerations were followed after seeking permission of the ethical committee of the institution. Accordingly a written informed consent was taken from Parents/Guardians. 50 subjects were randomized into two groups by random allocation software. The groups and drug administration is as under:

GP-A: They were administered commercially available preparation of intranasal midazolam @0.2 mg / kg as nasal spray.

GP-B: They were administered commercially available preparation of diazepam @ 0.3 mg/kg through IV route by placing an IV cannula of appropriate size. After administering the pulse rate and oxygen saturation was recorded at 0, 5 and 10 minutes.

Outcome was measured in terms of time taken from physician contact to cessation of seizures and from drug administration to cessation of seizures. The results were presented as mean and standard-deviation and statistically analyzed by using "student's unpaired t test" p -value (<0.05) was regarded as statistically significant. All analysis was performed using intention to treat analysis.

RESULTS:

A total of 50 subjects were studied over a period of 15 months. The two groups were comparable in terms of age, sex and prior history of seizure. Mean time from physician contact to cessation of seizures was significantly shorter in GP-A (IN MDZ) as compared to GP-B (IV DZP) and the difference was statistically significant (p =0.008) (Table 2). Time from drug administration to cessation of seizures was lesser in GP-B (IV- DZP) as compared to GP-A IN MDZ and the difference was statistically significant (p= 0.046) (Table III). Effect of drugs on pulse rate and oxygen saturation as observed in intergroup comparisons drawn was statistically insignificant between the two groups (Table 4). No significant effect was observed on recurrence rate and number of uncontrolled seizures.

DISCUSSION:

Seizure is a life threatening event and frightening experience for both parents and caregivers. Longer duration of seizure is associated with higher mortality and morbidity. Hence to abort an acute attack is the immediate need of a convulsing child. Parenteral routes like intravenous and intramuscular require hospital setting and expertise whereas rectal route has its own social and personal

Table 1 : Baseline Characteristics of intervention & the type of seizure in each group

Characteristics	Group A		Group B	
	Intranasal Midazolam (n=25)		Intravenous Diazepam (n=25)	
Median age (years)	5.0736		6.7368	
Male/Female, (M%)	36		26	
Type of seizures	Controlled (%)	Not Controlled (%)	Controlled (%)	Not Controlled (%)
GTCS	14 (56%)	2 (8%)	15 (60%)	3 (12%)
Partial	5 (20%)	0 (0%)	4 (16%)	0 (0%)
Focal Seizure progressing to secondary generalization	4 (16 %)	0 (0%)	3 (12%)	0 (0%)
Etiology of Seizures	Contolled (%)	Not Controlled (%)	Controlled (%)	Not Controlled (%)
Febrile Seizures	2 (8%)	0 (0%)	6 (24%)	0 (0%)
Meningitis	6 (24%)	0 (0%)	2 (8%)	1 (4%)
Epilepsy	9 (36%)	0 (0%)	9 (36%)	0 (0%)
Encephalopathy	4 (16%)	2 (8%)	4 (16%)	2 (8%)
Cerebral palsy with mental retardation	2 (8%)	0 (0%)	2 (8%)	0 (0%)
Others	0 (0%)	0 (0%)	1 (4%)	0 (0%)
Time needed to control seizures (min)	T1 3.988	T2 3.8720	T1 5.448	T2 3.1160

*GTCS: Generalized Tonic Clonic Seizures

Table 2: Depicting time from physician contact to cessation of seizures

Time from physician contact to cessation of seizures (T1)	Gp. A (Intranasal Midazolam) Time (min)	Gp. B (Intravenous Diazepam) Time (min)	p-value
Mean time & (SD) (n=50)	3.9880 (1.38784)	5.4840 (2.33661)	0.008

Table 3: Time from drug administration to cessation of seizures

Time from drug administration to cessation of seizures (T2)	Gp. A (Intranasal Midazolam) Time (min)	Gp. B (Intravenous Diazepam) Time (min)	p-value
Mean time & (SD) (n=50)	3.8720 (1.57229)	3.1160 (0.97112)	0.046

adverse effects (more so in adolescents). Therefore intranasal administration of midazolam has been area of tremendous interest in recent years. The ability of rich vascular nasal mucosa to absorb drug readily and helping quick attainment of peak plasma and CSF concentrations within minutes of administration make it the prime route for fast and easy drug delivery. Majority of subjects in our study were of 1-6 years of age and fairly uniformly distributed amongst the two groups.

Table 4: Comparison of O2 saturation & pulse rate in two group of patients receiving midazolam & diazepam

Parameters	Time (min)	Gp. A (Intranasal Midazolam)	Gp. B (Intravenous Diazepam)	p-value
O2 Saturation (%) Mean (S.D.)	0 min	97.16 (1.46287)	96.28 (2.24574)	0.107
	5 min	94.0800 (3.13475)	93.1200 (3.63226)	0.322
	10 min	94.8400 (1.65025)	94.6000 (2.02073)	0.648
Pulse Rate (/min) Mean (S.D.)	0 min	123.84 (28.15978)	137.0400 (27.41727)	0.100
	5 min	113.0400 (26.59022)	122.7600 (23.65953)	0.178
	10 min	116.0 (26.83282)	126.88 (24.37950)	0.140

There are reports of similar study groups.[9, 10] Majority of seizures were generalized tonic-clonic seizures which is in concordance with 70% reported frequency of GTCS in childhood seizures. [11] Recurrence rate in the two groups was 12% and 16% respectively, 8 % of seizures in group A and 12 % in group B failed to get controlled. The results are comparable with studies available in literature where seizure control with midazolam ranged from 75%-100%.[2,12,13,14,15] In our study we observed that intranasal midazolam is a safe and effective anticonvulsant for acute management of seizures. As time required from physician contact to cessation of seizures was considerably shorter 3.9880 min in group-A (IN MDZ) as compared to 5.4840 min in group-B (IV DZP), (p-value- 0.008), Intranasal midazolam proves it superiority over intravenous diazepam due to its speed & ease of administration. And such situations where seconds matter saving time can have significant impact on clinical outcome of a critically ill convulsing child and helps emergency physician to look into other aspects of critical care management. Reducing the duration of seizure also decreases the associated mortality and morbidity. Mean time from drug administration to cessation of seizures was 3.8720 min in group A and 3.1160 min in group B. p-value came out to be 0.046 which shows superiority of intravenous diazepam over intranasal midazolam. The results obtained are in concordance with other studies.[12,16,17,18,19] No adverse cardio respiratory effect was noted. These observations were comparable to other studies.[3,12,13,14]

CONCLUSION:

Intranasal midazolam is safe and effective for treating seizures in the hospital. Compared with the current standard of care using intravenous diazepam intranasal midazolam is more easier to use and is more socially acceptable.

Together, these advantages make intranasal midazolam a viable alternative to intravenous diazepam as the preferred method for treatment of seizures in patients without or having difficult intravenous access. The rapid onset of action of intranasal midazolam is noteworthy, given that early treatment can reduce the morbidity and mortality of children having seizures. Treatment should preferably start before arrival to the hospital, but only by trained health-care personnel or families.

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Effect of Different Growth Media and Physical Factors on Biomass Production of *Trichoderma Viride*

Research Article

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ABSTRACT

In the past decade, excessive use of chemical pesticides has increased environmental contamination which in turn increased the importance for biopesticides to control different plant pathogens and diseases. *Trichoderma viride* is potent biocontrol agent. To obtain the favourable conditions for the biomass production of *Trichoderma viride*, the present study was conducted on different growth media and various physical factors i.e. pH, temperature and humidity. The best growth of *Trichoderma viride* was observed on Sabouraud Malt Yeast extract Agar (SYMA) medium with colony diameter of 2 cm after 5 days of incubation. The stationary phase of growth of *Trichoderma viride* occurred from 9th day with the decline phase starting from the 11 day of incubation. *Trichoderma viride* favored acidic while poor mycelia development was observed on alkaline medium. Moreover, alkaline pH had inhibitory effect on the growth and development of mycelia and pigmentation of the fungus. *Trichoderma viride* could grow at a wide range of temperature between 20-30ºC. Best growth and sporulation of the fungus was observed at 28ºC, colony diameter of 2.6 cm and optimum pH at 6 with 3.7cm colony diameter and optimum relative humidity for sporulation was obtained at 80-90%.

KEY WORDS: biomass production, mycelial growth, pH, relative humidity, sporulation, temperature, *trichoderma viride*

INTRODUCTION:

The most widely used control measure for suppressing several soil borne fungal pathogens diseases are the use of fungicides. However, problems encountered, such as development of pathogen resistance to fungicides, various insecticides and inability of these to protect the roots of mature plants has its own limitations. The chemical methods to control soil borne diseases are very difficult and costly. Considering these limitations, bioagents are important and inexpensive in this direction.

Biological control is an eco-friendly approach towards plant protection where specific micro-organisms interfere in host. Antagonistic biocontrol agent is a potential approach for managing plant diseases. *Trichoderma viride* is one of the bioagents against several fungal pathogens which possess better ability to promote plant growth and soil remediation activity compared to their counterparts (virus, bacteria, nematodes and protozoa).[1] These antagonistic fungi are most common among fungal biocontrol agents because of their multiple characteristics, namely antagonism and plant-growth stimulation. Thus, mass-scale production of *Trichoderma* spp. would have great potential for commercial use.

Fungi being saprophytic or parasitic require an external source of nutrition. External source of carbon (C), hydrogen (H), oxygen (oxygen) and nitrogen (N) are utilized by *Trichoderma* sp. For the production of *Trichoderma* spp, addition of glucose, cellulose, soluble starch and molasses is the conventional method for semi-synthetic media.[2,3,4,5]

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The first of three principle elements are provided by carbohydrates, while nitrogen source may be in organic or inorganic form. Among different sources of carbohydrates, glucose is the preferred one for nearly every fungus. The enzyme system of fungi is well developed to synthesize other essential requirements from these basic elements.[6] *Trichoderma viride* is a potent organism serving from decades in biological control because it decreases or eliminates allelopathic chemicals, prevents the allelopathic effects of Vesicular-Arbuscular Mycorrhiza (VAM) fungi, increase acidification of soil thereby chances of pathogenic fungi are reduced due to antagonistc interactions and inhibits the growth of true dry rot fungus *Serpula lacrymans*, which is the most significant fungal cause of damage to timber in built environment in temperate regions of the world. In other case sudden death syndrome (SDS) in soyabean is one of the most destructive disease caused by *Fusarium virguliforme*, has gradually increased importance to discover biocontrol agents.[7,8]

Application of chemical fungicide has been replaced by biocontrol agents because of the emergence of fungicide-resistant strains and public concerns regarding the health and environmental impacts of these chemicals. During the past few decades, several potential biocontrol organisms have been isolated, characterized and commercialized. Now a days, biocontrol of plant diseases has received more consideration in plant disease control.[9,10] Thus, the present study was conducted to test the efficacy of different growth media and various physical factors on biomass production of *Trichoderma* spp. under invitro conditions.

MATERIALS AND METHODS:

Identification: Slide culture technique was adopted for the identification of different isolates of *Trichoderma viride*. Sterilized moist chamber was prepared by keeping thin cotton pad, a wet filter paper and a slide inside a sterilized petriplate. Simultaneously, saboraud dextrose agar medium was prepared and poured on a sterilized glass plate in the form of a thin film. On solidification this film was cut into small cubes with flamed scalpel and was placed on slides inside the moist chamber, later inoculated with fungal spores separately. These slide cultures were incubated at 28°C. After sporulation, the slide was stained with lactophenol cotton blue. For permanent mounts the cultures were stained with DPX.[11,12] Fungal identification was done on the basis of morph taxonomic characteristics whereas, microscopic examinations were carried out to ensure that the cultures were not mixed.[13]

Evaluation of growth and spore production of *Trichoderma viride*: Initially, *Trichoderma viride* cultures were grown on potato dextrose agar (PDA) and incubated at 25º to 30ºC for 5 days. Later, 0.5cm mycelium was transferred from 3 day old culture in 500 ml flasks containing potato dextrose broth (PDB) to obtain pure culture. Homogenous Trichoderma sp. culture was obtained by mixture of 0.1ml spore suspension grown in PDB, containing 10^6 spores/ml in water with 0.05% Tween 80 and spreading evenly on PDA and incubated at 28±1ºC in the dark. After two days, mycelium discs were removed with a sterile cork borer and transferred to different media i.e. Potato dextrose Agar (PDA), Potato Carrot Agar (PCA), Malt Extract Peptone Agar (MEP), Sabouraud Malt Yeast Extract Agar (SMYA), Sabouraud Dextrose Agar (SDA), COON'S Agar, Czapek Dox Agar, Richards Agar and Casein Agar to identify maximum growth of colony. Measurements of the mycelia growth were observed after five days of incubation at 28±1ºC (Table 1). The diameter of the colonies was estimated by calculating the mean of two perpendicular measurements. The sporulation rate was assessed after six days of incubation, individual petridishes were rinsed with 1ml of Tween 80 and the conidia were scraped off carefully. The spore concentration was determined with a haemocytometer and the viability of the conidia was examined on SMYA after 24 hours of incubation at 28±1ºC. [14,15,17]

The physical parameters were studied using SMY broth due to its potentiality as best growth media. Growth pattern of *Trichoderma viride*: 25 ml SMY broth each was inoculated with 1 ml of conidial suspension of *Trichoderma viride* and was incubated at 28 ±1ºC on rotary shaker at 25 RPM for agitation. The weight of mycelia (fresh and dry weight) was taken from 2 to 15 days of incubation. [17]

Determination of pH: 40 ml of SMYA media of pH gradient from 2 to 12 was prepared, sterilized and was poured in sterilized petriplates. After solidification of the medium, plates were inoculated by spot inoculation with *Trichoderma viride*. The inoculated plates were incubated at 28±1ºC. The colony diameter and characteristics were observed daily after an incubation period of 48 hours upto 7 days.

Effect of Temperature: To study temperature effect on growth of *Trichoderma viride*, inoculated petriplates of SMYA media were incubated at different temperature viz, 5, 10, 15, 20, 25, 28, 30, 35 and 40ºC

and observation were recorded after 7 days of incubation [15,16,18].

Effect of Relative Humidity (RH): Relative humidity on the growth and sporulation of *Trichoderma viride* was observed on solidified SMYA media. Inoculated petriplates were incubated at different relative humidites viz, 50, 70, 80, 90, 95 % [18]. Observations were recorded after 7 days of incubation.

RESULTS:

Influence on the growth and sporulation of fungi depends upon many factors *viz*., Temperature, light, micro and macro chemical compositions of the substrate. In the laboratory conditions, different growth patterns were observed for *Trichoderma viride* and was found capable to grow on almost all the media tested. But, Sabouraud Malt Yeast extract Agar proved to be the best suitable medium for the growth of *Trichoderma viride* with a colony diameter of 2.9 cm after 5 days of incubation amongst other media studied.

Growth is considered as an irreversible increase in the mass/volume of an organism that occurs after a given period of incubation, in nature or in laboratory. Growth of *Trichoderma viride* mycelium was performed using juvenile growth stage from SYM agar. It is necessary to consider vegetative growth in fungi separately as it exhibits different modes or patterns of growth. The results revealed that the stationary phase of growth of *Trichoderma viride* occurred from 9th day with the decline phase starting from the 11th day of incubation (Table 2).

Effect of hydrogen ion concentration or pH on the growth of *Trichoderma viride* favored slight acidic condition where optimum pH was 6, while poor mycelia development was observed on alkaline medium. At alkaline pH, 10, 11 and 12, inhibitory effect was observed on the growth and development of mycelia and pigmentation of the fungus.

In our study, the effect of temperature was observed. The best growth and sporulation of the fungus was obtained at 28ºC and to lesser extent at 30ºC, as exhibited by colony diameter i.e. 2.9 and 2.5cm and sporulation/spore count i.e., 5918 and 5433 respectively. At 25ºC, the colony diameter was 2.6 cm and sporulation was good (5473). Colony characteristics were similar, except that much flosses growth was visible in sporulating colony at 25, 28 and 30ºC. There was no growth below 10ºC, but inoculum started rooting in the media. At 15ºC, greenish mycelial growth was observed with a diameter of 0.6cm. Moreover, at 35ºC the colony was small with a diameter of 0.4cm without sporulation and there was no growth at 40ºC (Table 4).

The present isolate of *Trichoderma viride* was capable to grow and sporulate at different levels of relative humidity. The fungus attained its best growth and sporulation at 80 and 90%RH, with colony diameter measuring 3.0 and 2.7 cm respectively. At 50 and 70% RH, the colony diameter was 1.2 cm with moderate sporulation; at 90% RH and 95% RH, colony diameter was 2.7 and 2.2 cm respectively. The colony characteristics at different humidities were similar except that the fungal growth was highly floccose and powdery in the sporulating fungus at 80%RH with 3.0cm diameter. Thus, optimum relative humidity increased growth at 80% RH, but decreased with increase in %RH at 95, as sporulation decreased with spore count 1.2×10^5 spores/ml. The minimum time required for sporulation in saturated atmosphere was found to be 3 days. *Trichoderma viride* sporulated with relative humidity as low as 50% which proves its superiority over other isolates of *Trichoderma*.

Table 1: Effect of Different Media on the growth of *T. viride.*

S.No	Name of Medium	Colony Diameter (cm)
1	Casein Agar	1.7
2	Coon's	1.0
3	Czapek Dox Agar	1.4
4	Malt Extract Peptone Agar (MEP)	1.4
5	Potato Dextrose Agar (PDA)	0.9
6	Potato Carrot Agar (PCA)	2.0
7	Richard's Agar	1.3
8	Sabouraud Dextrose Agar (SDA)	2.6
9	Sabouraud Malt Yeast extract Agar (SYM)	2.9

DISCUSSION:

Influence on the growth and sporulation of fungi depends upon many factors *viz*., Temperature, light, micro and macro chemical compositions of the substrate. In the laboratory conditions *Trichoderma viride* was found capable to grow on almost all the media tested with different growth patterns. Sabouraud malt yeast extract agar proved to be the best suitable medium for the growth of *Trichoderma viride*. Moreover, the yeast extract in the medium acted as an inducer for the growth of certain fungi and is responsible for the instant growth radially.[13]

Growth is considered as an irreversible increase in the mass/volume of an organism that occurs after a given period of incubation, in nature or

Table 2: Growth Pattern of *T. viride*

Days of Incubation	Weight of filter paper (g) (A)	Total weight (g) (B)	Wet Mycelial Weight (g) C= B-A	Dry Mycelial weight (g) (D)	Loss in weight = C-D
2	0.546	0.679	0.133	0.061	0.072
3	0.338	0.540	0.202	0.094	0.108
4	0.543	0.788	0.245	0.084	0.161
5	0.407	0.594	0.187	0.067	0.120
6	0.496	0.673	0.177	0.089	0.088
7	0.361	0.636	0.275	0.109	0.166
8	0.414	0.530	0.116	0.052	0.064
9	0.558	0.847	0.289	0.106	0.183
10	0.564	0.752	0.188	0.113	0.075
11	0.667	0.903	0.236	0.171	0.065
12	0.585	0.831	0.246	0.118	0.128
13	0.412	0.573	0.161	0.105	0.056
14	0.502	0.631	0.129	0.078	0.051
15	0.571	0.713	0.142	0.116	0.026

Table 3: Effect of pH on the Growth of *T.viride*.

S.No	pH	Colony Diameter (cm)	Colony Characteristics
1	2	0	No Growth
2	3	0	No Growth
3	4	0	No Growth
4	5	2.4	Light Green colony and white outer circumference
5	6	3.7	Thick greenish colony with cottony white outer circumference and elevation at the centre
6	7	2.6	Depressed growth, greenish at centre elevation.
7	8	2.1	Light green cottony colony
8	9	2.0	Thin green colony
9	10	0.7	Depressed Thin cottony colony
10	11	0	No Growth
11	12	0	No Growth

Table 4: Effect of Different Temperatures on the Growth of *Trichoderma viride*

S.No	pH	Colony Diameter (cm)	Colony Characteristics
1	2	0	No Growth
2	3	0	No Growth
3	4	0	No Growth
4	5	2.4	Light Green colony and white outer circumference
5	6	3.7	Thick greenish colony with cottony white outer circumference and elevation at the centre
6	7	2.6	Depressed growth, greenish at centre elevation.
7	8	2.1	Light green cottony colony
8	9	2.0	Thin green colony
9	10	0.7	Depressed Thin cottony colony
10	11	0	No Growth
11	12	0	No Growth

in laboratory. The results revealed that the stationary phase of growth of Trichoderma viride occurred from 9th day with the decline phase starting from the 11th day of incubation. It is necessary to consider vegetative growth in fungi separately as it exhibits different modes or patterns of growth [19].

It was observed that the growth and development of mycelia and pigmentation of *Trichoderma viride* was favored by slight acidic condition and alkaline pH showed inhibitory effect. It

Table 5: Effect of Different Levels of Relative Humidity on the Growth of *T. viride*

S. No	Percent Relative Humidity	Colony Diameter (cm)	Sporulation/ Spore count/ml	Colony Characteristics
1	50	1.2	Moderate/ 0.85×10^4	Colour is initially greenish and become green, colony white in revere side.
2	70	1.5	Moderate/ 0.85×10^4	Colony is initially greenish and become green, white in reverse side
3	80	3.0	Excellent/ 1.8×10^5	Green and and become greenish and white in reverse side.
4	90	2.7	Excellent/ 1.7×10^5	Green and and become greenish and white in reverse side.
5	95	2.2	Good/ 1.2×10^5	Green colony, white in reverse side.

was considered that change in the pH of a medium alters its composition due to weakly ionized constituents, thus, affecting the physiological effects of dissociated and undissociated species. Most of the fungi grow within the pH range 4-8; whereas, many fungi grow over a wider range, and a few have been reported to have a narrower range. [20] However, in the present study *Trichoderma viride* was best grown at pH 6 which declined with increase in pH

Temperature has been considered for a long time to be one of the important factors affecting the natural activity of parasitic fungi. Much information is available on the effect of temperature on growth of entomogenous fungi in vitro. [21,22] Generally, the limit for growth range between 10-35ºC and the optimal fall between 20 and 30 ºC. Robert and Yendol (1971) and Ferron (1978) described the influence of temperature and relative humidity on muscardian fungi and stated that the rapidity of mycelia development and thereby infection depends on temperature.[23,24] Previously, in vitro effect of temperature had been reported for Beaveria bassiana where limit was 5-35ºC with optimum and growth between 20-30ºC.[21,24,25,26]

In various studies conducted, it was observed that *Trichoderma viride* could grow at a wide range of temperature between 20-35ºC. But our results describes the optimum temperature 28ºC to be best for the growth and sporulation of the fungus

Environmental humidity and the interaction of these factors in the ecological complexes, influence the development of a fungal pathogen [27]. Effect of different levels of relative humidity undoubtedly plays a very important role in sporulation on growth of *Trichoderma viride*. The present study suggested that *Trichoderma viride* was capable to grow and sporulate at different levels of relative humidity where it attained its best growth and sporulation at 80 and 90% RH. However, the optimum relative humidity increased growth at 80% RH, but a decrease was later observed with increase in %RH at 95. Lower humidity levels had some sort of retarding effect on the growth and sporulation. [28,29,30] *Trichoderma viride* sporulated with relative humidity as low as 50% which proves its superiority over other isolates.

CONCLUSION:

In recent years, the fertility of soil is deteriorated due to the prevailing chemical pesticides. Scientist is keen to recover the species which could be used without negative impact on ecology. The research broadens the aspects of *Trichoderma viride* to be utilized as an agro product to offset the pest resistance and provide the alternative and cheap source for the mass production of the specie. *Trichoderma viride* had been previously reported as bio-pesticide. Thus, the current study concludes that the mass production of the *Trichoderma viride* can be increased by standardizing the physical factors. It is also concluded that Sabouraud Malt Yeast extract Agar is the most suitable media for the growth and sporulation of *Trichoderma viride*.

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Needle Stick Injuries Among Health Care Worker

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Research Article

ABSTRACT

Needle stick injuries (NSIs) are wound caused by sharps such as hypodermic needle, blood collection, intravenous cannulas or needle used to connect part of intravenous delivery system. In India, authentic data on NSIs are scarce. It is known that 3-6 billion injection are given per year, of which 2/3 rd injection are unsafe (62.9%) and the use of glass syringe is constantly associated with higher degree of unsafety. Determinants of NSIs are over use of injections and unnecessary sharps, lack of supply of disposable syringes, safer needle devices, and sharps-disposal containers, recapping of needles after use, passing instruments from hand to hand in the operating suite, lack of awareness of hazards and lack of training. The objective is to study the prevalence and type of needle stick injuries in health care workers in Rohilkhand Medical College and hospital, Bareilly. This cross-sectional study was conducted in month of January 2012 to December 2012. Simple Random Sampling method was used for sample size 312, including 52 participants in each category. A Semi-open pre-tested validated questionnaire was used in the study. Data was analyzed using Statistical Package for the Social Sciences (SPSS) version12, Chi-square test was applied as a test of significant. Needle stick injuries were present in 56.2% health care works. Injuries were more in OT technicians. Many times these injuries were self -inflicted. Hospital based intervention programs and awareness was effective in prevention of needle sticks injuries and our results quantitatively supported these arguments.

KEY WORDS: needle stick injuries, health care workers, simple random sampling.

INTRODUCTION:

Needle stick injuries (NSIs) are wound caused by sharps such as hypodermic needle, blood collection, Intravenous (IV) cannulas or needle used to connect part of IV delivery system.[1] Because of the environment in which health care workers (HCWs) work, many worker are at an increased risk of accidental needle stick injuries. Globally NSIs are the most common source of occupational exposures to blood and the primary cause of blood-borne infections to HCWs.[2] Determinants of NSIs are overuse of injections, lack of supplies of disposable syringes, safer needle devices, sharps-disposal containers, recapping of needles after use, passing instruments from hand to hand in the operating suite, lack of awareness of hazard and lack of training are the important determinants of NSIs.[3]

Health-care workers working in the operation theatre, labour rooms, emergency, laboratories and ward have an increased risk of exposure and they experience significant fear, anxiety and emotional distress which can sometimes result in occupational and behavior changes.[4]

As the data of needle stick injuries are of tenunder reported, the health care institutions should not interpret low report ingrate while 90% of the occupational exposuresoccur in the developing world, 90% of the reports of occupational infection occur in the United States and Europe. [5] NSIs exposure in African countries is higher than elsewhere and a significant public health issue due to the fear of occupational infections faced by ill-paid, ill-protected and overworked health-care workers.[6] It is known that 3-6 billion injections are given per year, of which 2/3rd injections are unsafe (62.9%) and the use of glass syringe is constantly associated with higher degree of poor safety.[7]

Needle stick injuries have significant indirect consequences in health care delivery especially in the developing countries, where already the qualified work force is limited with respect to the diseases burden in the population. These injuries not only

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potentiate negative health consequences but also cause emotional distress in health care workers which results in missed work days and directly affect the health care services and resources.[8]An authentic data on NSIs is scarce because of underreporting of NSIs. The misconception exists that the healthcare industry is clean and without hazard, when in fact the chemical and blood-borne exposures encountered can be career and life-ending. The risk of occupational transmission has been extrapolated by the WHO to convey the risk of an unsafe injection.[9] As a result these workers are at risk of occupational acquisition of blood borne pathogens such as hepatitis B virus (HBV), hepatitis C virus (HCV), Human Immunodeficiency Virus (HIV)and other diseases. According to WHO study, the annual estimated proportion of HCWs exposed to blood borne pathogens globally were, HCV (2.6%), HBV(5.9%), HIV (0.5%). Other infections transmittable through needle sticks include syphilis, malaria, and herpes.[10]

The occupational risk of needle stick injuries not only affects the quality of care delivered but also the safety and well-being of care providers.[11] The consequences of HBV infection are potentially fatal and include chronic liver disease, cirrhosis, and primary hepatocellular carcinoma.[12] Hepatitis C and HIV, are two most serious of the 20 blood-borne pathogens that healthcare workers are exposed to in their daily work caring for the world's health.

Seventy percent of the world's HIV population lives in Sub-Saharan Africa, but only 4% of worldwide occupational cases of HIV infection are reported from this region.[3] The average risk of transmission of HIV to a health care worker due to percutaneous exposure to HIV infected blood has been estimated as three in one thousand.[14]Factors that increase risks of transmission of HIV include a deep wound, visible blood on the device, a hollow-bore blood-filled needle, use of the device to access an artery or vein, and high viral load status of the patient.[15]

Knowledge on the transmission of blood borne disease in health care facilities is very limited and unsafe practices are common. Additionally there is a lack of regulation and polices to protect health care workers from exposure.[16]

AIM AND OBJECTIVES:

To study the prevalence and type of needlestick injuries among health care workers in a tertiary care hospital, Bareilly.

MATERIALS AND METHODS:

A cross-sectional study was carried out to study the prevalence and type of needle stick injuries among the health care workers in month of January 2012 to December 2012 at Rohilkhand Medical College and Hospital, Bareilly.[17]

The Sample size derived was 281. An additional 10% for non-response was added to give a sample size 309 HCWs. Final sample size of 312 HCWs was taken for equal distribution of the respondents in each group. Total 312 participants were imparted in the study comprising 52 participants in each category. HCWs working in various departments, where exposure to needle stick injury might occur were taken. They were categorized on the basis of their occupation i.e. Resident doctors, Interns (M.B.B.S), Nursing staff, Nursing students, Lab technician, and OT technician and individuals were selected randomly from each selected occupation. The inclusion criteria were health care workers in the hospital, both male and female and including those professionals who normally use the needle. Exclusion criteria were all professors, specialists, consultants and the health care workers of the departments who do not normally use the needle stick. Data collection was done by using a semi-open, pre-tested validated questionnaire that was filled by the participant. The questionnaire was constructed in English. Investigator visited the hospital on one day during the survey period to distribute and collect these self-administered questionnaires from the HCWs. Data thus collected were entered into a computer-based spreadsheet for analysis and Statistical package for social science was used for calculations. Chi square test was applied to establish the statistical association between the two variables. p value of <0.05 was considered statistically significant.

RESULTS:

Among 312 HCWs in the study, it was observed that 164 HCWs were encountered with

Table 1: Distribution of health care workers according to history of needle stick injury during previous 12 months (n=312) and source of injury (n=164).

Healthcare Workers	Needle stick injury				Source of Injury		
	Present		Absent	Total	Self-inflicted (Accidental)	Someone else	Total (%)
	Number 1 (%)	Number =2 (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Nursing Staff	5 (9.6)	30 (57.6)	17 (32.7)	52 (100.0)	33 (24.6)	2 (6.7)	35 (21.3)
Nursing Student	4 (7.7)	32 (61.5)	16 (30.8)	52 (100.0)	34 (25.4)	2 (6.7)	36 (21.9)
Intern	12 (23.1)	11 (21.1)	29 (55.8)	52 (100.0)	21 (15.7)	2 (6.7)	2 3(14.2)
Lab Technician	1 (1.9)	17 (32.6)	34 (65.4)	52 (100.0)	14 (10.5)	4 (13.3)	18 (10.9)
O.T.Technician	3 (5.8)	33 (63.5)	16 (30.8)	52 (100.0)	20 (14.9)	16 (53.3)	36 (21.9)
Resident Doctor	8 (15.5)	8 (15.3)	36 (69.2)	52 (100.0)	12 (8.9)	4 (13.3)	16 (9.8)
Total	33 (10.6)	131(41.9)	148 (47.4)	312 (100.0)	134 (100.0)	30 (100.0)	164 (100.0)

$\chi^2 = 24.00$, df = 10, p = 0.001 (Figures in parenthesis are percentage) $\chi^2 = 26.170$, df = 5, p = 0.001

Table 2: Distribution of health care workers with respect to procedure performed during needle stick injury

Health care workers	Procedure during needle stick injury					Total
	Intra Venous	Intra Muscular	Sub Cutaneous	Intra Dermal	Suturing	
	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)	Number (%)
Nursing Staff	22 (62.9%)	10(28.6%)	1(2.9%)	2(5.7%)	2(5.7%)	35(100.0%)
Nursing Student	20 (55.6%)	16(44.4%)	0(0.0%)	0(0.0%)	0(0.0%)	36(100.0%)
Intern	8 (34.8%)	12(52.2%)	2(8.7%)	1(4.3%)	1(4.3%)	23(100.0%)
Lab Technician	15 (83.3%)	0 (0.0%)	0 (0.0%)	3 (16.7%)	0 (0.0%)	18 (100.0%)
O.T. Technician	16 (44.4%)	20 (55.6%)	0 (0.0%)	0 (0.0%)	2 (5.6%)	36 (100.0%)
Resident Doctor	3 (18.8%)	13 (81.3%)	0 (0.0%)	0 (0.0%)	2 (12.5%)	16 (100.0%)
Total	82 (50.0%)	66(40.2%)	3 (1.8%)	6 (3.7%)	7 (4.3%)	164 (100.0%)

needle stick injuries. The prevalence of needle stick injury among HCWs was 52.6%. It was observed that two or more needle stick injuries maybe found in the same person. Nursing students and OT technicians have got the highest occurrence of needle stick injuries (69.2%) followed by nursing staff (67.3%) however it was lower among the resident doctors (30.8%) and lab technician (34.6%) because of lesser exposure with needle. Table 1 tells about that which category of the HCWs is more commonly affected by the NSI during the past twelve month**.** The main source of the injuries in present study was self-inflicted 134 (81.7%) which was highest among nursing students (25.4%) followed by nursing staff (24.6%) and lowest among the resident doctor (8.9%) which was due to the lesser exposure to the needles. Interpretation of table 3 and 4 shows that statistical association was found highly significant between the presence and absence of Needle Stick Injury variable, Source of injury was 'self-inflicted' and 'someone else variable' (Table 1).

Table 2 shows that majority of the injuries were observed during the intravenous procedure (51.2%) followed by intramuscular (IM) procedure (45.1%). It also shows that majority of lab technicians were injured by needle stick during intravenous procedure (83.3%) followed by nursing staff, nursing students, OT technicians, interns and resident doctors (62.9%, 55.6%, 44.4%, 34.8% and 18.8%

Table 3: Distribution of health care workers according to type of device causing injuries

Health Care workers	Type of device causing injuries			
	Disposable needle	Suture needle	Reusable needle	Total
	Number (%)	Number (%)	Number (%)	Number (%)
Nursing staff	33 (94.3%)	1 (2.9 %)	1 (2.9%)	35 (100.0%)
Nursing student	32 (88.9%)	2 (5.6 %)	2 (5.6%)	36 (100.0%)
Intern	14 (60.0%)	9 (39.1%)	0 (0.0%)	23 (100.0%)
Lab technician	18 (100.0%)	0 (0.0%)	0 (0.0%)	18 (100.0%)
O.T.technician	17 (47.2%)	19 (52.8%)	0 (0.0%)	36 (100.0%)
Resident doctor	10 (62.5%)	5 (31.3%)	1 (6.3%)	16 (100.0%)
Total	124 (75.6%)	36 (22.0%)	4 (2.4%)	164 (100.0%)

$\chi^2 = 46.501$, df = 10, p = 0.001 (Figures in parenthesis are percentage)

respectively). Highest numbers of resident doctors (81.3%) were injured during intramuscular procedures followed by OT technicians, interns, nursing students and nursing staff (55.6%, 52.2%, 44.4% and 28.6% respectively). During subcutaneous procedures, only 8.7% of interns and 2.9% of staff nurses were injured. Similarly only 16.7% lab technicians along with 5.7% of staff nurses and 4.3% of interns were injured during intradermalprocedures. While during suturing, 12.5% of resident doctors were injured followed by 5.7% of staff nurses, 5.6% of OT technicians and 4.3 % of interns (Table 2).

The most common source of NSIs was needle (75.6%) of the disposable syringe in our study followed by suture needle (22.0%) and re-usable needle (2.4%) because of more usage of disposable syringeas compare to other, which was highest among O.T. technicians (100%) followed nursing staff (94.3%) and nursing students (88.9%) respectively. Suture needle (52.8%) was the main cause of injuries among O.T. technicians (52.8%) (Table 3).

DISCUSSION:

The prevalence of needle stick injury came out to be 52.6% which is in consonance with study conducted by Musa (57.1%)[18] among primary health care worker in northern state of Nigeria however this percentage is much higher (52.6%) than the study conducted by Rampal in Malaysian (23.5%) [19]where as higher prevalence of NSIs was reported by various studies[20,21].The main cause of the injury in present study was self-inflicted (81.7%). This finding is similar with that of study conducted by Sharma et al[8] (84.4%) however study done by Goswami et al[2]shows that 100% of the reported injuries were self-inflictedwhich was higher than our study (Table1).

In this study, 81.3% of the resident doctors were injured during intramuscular procedures and injury accounted due to suturing was 12.5% while in the study conducted by Lee et al 81.8% of house officers were injured during suturing and 31.8% were injured during parenteral injections (Table 2).

The needle on the disposable syringe (75.6%) was the most common source of the NSIs inthe study conducted by Sharma et al [18] study while in our study 76.9% of the injuries were occur due to disposable needle whereas in [1] Various other studies like Muralidhar, Goswami[22]had reported similar findings.The degree of freedom for chi square test can be calculated by using (row-1) (column-1), according to this (6-1) (3-1) = 10 has been taken in table 1 and 3 (Table 3).

CONCLUSION:

Needle sticks injuries is a global public health issue that needs attention of health policy makers.

Hospitals are the best avenue to address this global problem and our result quantitatively supported this arguments. The best hospital based intervention program will be one, which will reduce prevalence of NSIs. Public health persons especially HCWs have to lead in the hospital based interventions program.
Various intervention programs may be:

a) Orientation and Training Program- Reducing NSI among health care providers by educating the target groups (medical student, nursing students etc.) and evaluate it before and after design and implementation of the program specially making them understand the Dos and Don'ts while handling the needles and sharps.

b) Comprehensive Program: Safe work practice and safe needle device is a part of comprehensive program me to prevent the transmission of blood borne pathogens.

c) Universal precaution: HCWs must follow CDC guidelines for safe healthcare practices i.e. they should always use personal protective equipments.

Limitation - Consultant are not taken in our study because of lesser exposure with needle stick. Recall bias can not be ruled out as the recall period is long enough to be remembered. There is a possibility of concealingthe actual number of NSIs by the respondents due to fear of humiliation.

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Research Article

Microbiological Evaluation of Catheter Associated Urinary Tract Infection in a Tertiary Care Hospital

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ABSTRACT

Urinary tract infections are the most common type of healthcare-associated infection, accounting for more than 30% of infections reported by acute care hospitals. Virtually all healthcare-associated UTIs are caused by instrumentation of the urinary tract. Catheter-associated urinary tract infection (CAUTI) has been associated with increased morbidity, mortality, hospital cost and length of stay. In addition, hospital acquired CAUTIs are often due to multidrug resistant strains which require higher antibiotics and these strains may spread to other patients.

Urine samples from all adult patients admitted without any recent history of UTI and where a Foley's catheter was introduced in the past 24 hours is aseptically collected, analysed by microscopy and cultured for microbiological profiling. Antibiogram of clinical isolates was studied and CAUTI was observed in 64 samples out of 220 samples collected. The most frequent isolates were E.coli (34.85%), Klebsiella spp (19.7%), Pseudomonas spp (12.12%), Candida spp (10.6%), Enterococcus spp (6.06%), CONS (6.06%), Staphylococcus aureus (4.55%), Citrobacter spp (3.03%) Proteus spp (3.03%). Infections were more with female sex, prolonged catheterization, old age and diabetes. Longer duration of catheterization increased the chances of CAUTI. Emphasis should be placed on good catheter management rather than the use of prophylaxis to reduce the incidence of CAUTI.

KEY WORDS: catheter-associated urinary tract infection (CAUTI), nosocomial urinary tract infection (NUTI), urinary tract infection (UTI)

INTRODUCTION:

Urinary tract infection (UTI) is defined as invasive disease by microorganisms, inducing an inflammatory response and symptoms and signs such as fever > 38°C, urgency, frequency, dysuria without any other cause.

Nosocomial urinary tract infection (NUTI) refers to an UTI acquired in a hospital setting. In two thirds of the cases, the bacteria causing these infections are endogenous.

The urinary tract is the commonest site of nosocomial infections, accounting for 40% of infections. About 66% to 86% of these infections follow instrumentation of the urinary tract, particularly catheterization.

The urinary catheter is an essential part of modern medical care. It is widely used to relieve anatomic or physiologic obstructions, to provide a dry environment for the comatose or incontinent patients, and to permit the accurate measurement of urinary output in severely ill patients. Unfortunately, when used inappropriately or when left in place for too long, it is a hazard to the very patients that it is designed to protect.

Routes of infection[1]

- At the time of catheter insertion where organisms may be pushed into the previously uninfected bladder.
- Extra luminal colonization of the catheter with ascension of organisms into the urinary tract.
- Intraluminal colonization of the catheter with ascension of microorganisms. [Closed systems are designed to minimize intraluminal infection by preventing exogenous contamination]
- Acquisition of the infection via the lymphatic or haematogenous route is a proven, though minor portal of entry.

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Within 8 hours of insertion of a catheter, a biofilm can be found on the surface of the catheter, drainage bag and mucosa consisting of Tamm-horsefall protein, struvite and apatite crystals, bacterial polysaccharides, glycocalyces and living bacteria and is composed of three layers. Organisms within the biofilm are well protected from mechanical flushing by urine flow, other host defences and antibiotic.[7]

Most nosocomial UTI can be benign but a systemic complication, which is gram negative bacterimia, can develop in 30-40% of patients.

Duration of catheterization is the most important, consistent risk factor for catheter associated bacteriuria; approximately 97% of UTIs in the ICU are associated with an indwelling urinary catheter. Bacteriuria develops quickly at an average daily rate of 3% to 10% per day of catheterization. Bacteriuria will develop in 26% of patients with a catheter in place for 2 to 10 days. All patients catheterized for a month will develop bacteriuria. Long-term catheterization is defined as catheterization for greater than 1 month.

Recurrent problems with these nosocomially acquired catheter-related urinary tract infections are the changes in the microbiological and antibiotic sensitivity pattern of the pathogen isolated. Documented phenomena include: the emergence of extended spectrum beta lactamase producing *E.coli*, the tendency of the fluoroquinolones both to select for resistant strains of major UTI pathogens and to induce cross-resistance among different drug classes, and beta lactum and vancomycin resistance of enterococci and coagulase-negative Staphylococci.

Catheter-Associated Urinary tract Infection (CAUTI) can lead to complications such as cystitis, pyelonephritis, gram-negative bacteremia, prostatitis, epididymitis, and orchitis in males and, less commonly, endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis in all patients. Complications associated causes discomfort to the patient, prolonged hospital stay and increased cost and mortality.[8]

Prevention of nosocomial UTI and its complications would therefore reduce the rate of morbidity and mortality and expenses secondary to infection.[5] The study had been undertaken to describe the microbiological profile of catheter associated UTI and its correlation with duration of catheterization, consequences of urethral catheterization in terms of the incidence of the catheter-related infection, the risk factors associated with its acquisition and to detect/reveal the causative microbiological pathogens and their antibiotic susceptibility pattern.

MATERIALS AND METHODS:

Inclusion criteria: Adult patient with a Foley's catheter introduction [taking all aseptic precautions] in the past 24 hours without any previous history of Urinary Tract Infection (UTI) in the recent past at different wards and ICU of the Hospital were included in the study. The catheter material used is latex and is from same manufacturer for all patients.

Exclusion criteria included. (a) · Patients aged below 18 years were excluded from study; (b) Patients whose initial urine sample [taken within 24 hours of catheterization] with bacteriuria [105 CFU/ml or more] and patients whose catheters were removed or those who was discharged or transferred or who expired before obtaining urine sample for the day 3 culture were also excluded from the study; (c) Patients in whom the indwelling urethral catheter were in situ at the time of admission to the specialty, with the exception of those with catheters inserted in operation theatre and in the emergency department; (d) Patients in whom the indwelling urethral catheter was inserted before the start of the UTI surveillance period or the indwelling catheter has been in place for less than 48 hours; (e) Patients having suprapubic catheterization and (f) Patient who was undergoing treatment for UTI when the catheter was inserted.

In the study, a due consent was taken from patient/patient party. Patients excluding above criteria were admitted in different wards, ICUs of N.K.P. Salve Institute of Medical sciences and Research Centre, Nagpur, Maharashtra and followed up till 7th day of post-catheterization. Urine samples were collected on 3rd, 5th and 7th day after an initial screening. Patients were followed up to 48 hours after removal of the catheter and on removal of catheters on 5th/6th day, a follow up was done up to 7th day. The catheter tubing was clamped away from the sampling area, which was as near to the urethral meatus as possible (to collect freshly voided sample).

The site of sampling was prepared and the concerned part of the catheter was first rubbed with sterile cotton soaked in povidone iodine and then 70% ethyl-alcohol being used to disinfect the outer surface of the catheter.

The urine sample was collected by aspiration from the prepared site with a sterile 2c.c. disposable syringe with needle. The sample were then quickly transferred in a sterile container and processed within 2

hours.[9,10]

The collected samples were analysed using microscopy and culturing for microbiological profiling. The identification of isolates was done following standard microbiological procedures.[10] Antibiogram of the clinical isolates was studied.

RESULTS:

Over a period of 2 years, patients admitted at various medical, surgical wards and Intensive care units were studied. A total 220 patients were followed up with respect to clinical features, risk factors, microbiological profile of CAUTI and antibiotic susceptibility. 64 cases developed CAUTI and the incidence rate was 29.09%.

In our study, the total catheterized male patients were 115 and 105 female patients respectively. The number of CAUTI cases in males was 28 (24.35%) and in females 36 (34.29%). For both male and female patients, number of CAUTI cases was minimum at the lower age group of patients, and the number increased with rise in the age group (Table 1).

Out of 64 CAUTI cases, maximum incidence was from >75 years age group which had 2 CAUTI cases out of 3 patients [66.67%] and minimum was from 18-25 years age group which had 2 cases out of 17 patients (11.76%). CAUTI were detected more in females (36 out of 105 patients, 34.29%] than in males [28 out of 115 patients, 24.35%). It was observed that, 9 patients (14.06%) had fever, 4 patients (6.25%) showed suprapubic tenderness, whereas only 2 patients (3.13%) complained of mild costovertebral angle pain. Dysuria was complained by 5 patients (7.81%) and urgency was complained by 3 patients (4.69%). However, tenderness could not be elicited clinically. Rest of the patients were asymptomatic.

The CAUTI cases were detected from 3rd day of catheterization onwards and increased with the duration of catheterization. Maximum cases were detected on 7th day of catheterization (50.0%). It was also found that older age and presence of diabetes mellitus were risk factors for CAUTI.

A total of 66 isolates were recovered from 64 CAUTI cases. Gram negative bacilli showed predominance causing 72.73% of CAUTI and gram positive cocci caused 16.67% of CAUTI while, rest was fungal isolates. In our study, E.coli was the most common isolate followed by Klebsiella species. 2 samples showed presence of more than 1 organism. The most frequent isolated pathogens were E.coli (34.85%), Klebsiella spp (19.7%), Pseudomonas spp (12.12%), Candida spp (10.6%), Enterococcus spp (6.06%), CONS (6.06%), Staphylococcus aureus (4.55%), Citrobacter spp (3.03%) and Proteus spp (3.03%) (Table 2). All the gram negative isolates were sensitive to imipenem. E.coli and Pseudomonas spp showed maximum sensitivity to Piperacillin-Tazobactum. While, Klebsiella spp showed maximum sensitivity towards ceftazidime. All the recovered gram positive isolates displayed sensitivity against vancomycin. CONS, Staphylococcus aureus and Enterococcus spp were most sensitive towards linezolid and ciprofloxacin. It was pragmatic that all gram negative and positive isolates were least sensitive to ampicillin.

Most of the available references isolated Candida in pure culture and mentioned it in the list of the isolated organisms but did not mention about its antifungal sensitivity. Even the study of Kamath et al mentioned Candida as a causative organism, and claim that the incidence is in agreement with other studies did not mention antifungal sensitivity of Candida. Only the antibiogram of the gram positive and gram negative organisms were given in their study.

DISCUSSION:

In the present study, out of 220 cases studied 64 developed CAUTI. The incidence of CAUTI was found to be 29.09%. The incidence of CAUTI ranged from as low as 5% to as high as 73% among catheterized patients.[11,12] This result are in corroboration with studies of Garibaldi et al., (1974) and Alavaren et al., (1993) where Urinary Tract Infection in Patients and factors in predisposing to bacteriuria during indwelling urethral catheterization was observed.[13,14]

In our study, the number of CAUTI cases increased with increase in the age of the patient, maximum incidence was from >75 years age group

Table 1: Age and sex wise distribution of CAUTI cases.

Age Group in years	Males n=113			Females n=105			Male & Female combined n=218		
	Total patients	CAUTI + VE	Percent (%)	Total patients	CAUTI + VE	percent (%)	Total patients	CAUTI + VE	percent (%)
18-25	9	1	11.11	8	1	12.5	17	2	11.76
26-35	14	1	7.14	15	3	20	29	4	13.79
36-45	19	2	10.53	16	4	25	35	6	17.14
46-55	24	4	16.67	26	8	30.77	50	12	24.0
56-65	32	12	37.5	22	10	45.45	54	22	40.74
66-75	15	7	46.67	17	9	52.94	32	16	50.0
>75	2	1	50	1	1	100	3	2	66.67
Total	115	28	24.35	105	36	34.29	220	64	29.09

Table 2: Microbial profile in CAUTI cases.

ORGANISM ISOLATED	NO OF ISOLATES n=66	PERCENTAGE [%]
E. coli	23	34.85
Klebsiella spp.	13	19.7
Pseudomonas spp.	8	12.12
Candida spp	7	10.6
Enterococcus spp	4	6.06
CONS	4	6.06
Staphyloccus aureus	3	4.55
Citrobacter spp	2	3.03
Proteus spp	2	3.03

which had 2 CAUTI cases out of 3 patients (66.67%) and minimum was from 18-25 years age group which had 2 cases out of 17 patients (11.76%). When association was seen between age > 45 years and age <45 years considering both males and females together, it was found to be statistically significant (p value 0.0005). The odds ratio was 4.65, which displayed that those aged > 45 years possess the risk of developing CAUTI 4.65 times more, than those who aged < 45 years. In our study population of catheterized patients, males were more than females. Occurrence of CAUTI was more in female patients i.e., 36 out of 105, (34.29%), than that of male patients i.e., 28 out of 115, (24.35%). The association was not significant in the study due to smaller sample size. Age and female sex have been observed as significant risk factors by most workers.[14,15]

Duration of catheterization is strongly associated with risk of infection i.e., the longer the catheter is placed, higher is the incidence of urinary tract infection. The incidence of bacteriuria in catheterized patients is directly related to the duration of catheterization; the daily rate of acquiring bacteriuria is approximately 3% to 10%. In our study, patients were followed-up till 7th day of catheterization and out of 64 cases, 10 (15.63 %) were detected within 3 days, 22 (34.38%) within 5 days and 32 (50.0%) in 7 days of catheterization.

In the present study, 14 patients (21.88%) possessed diabetes mellitus and to compare the results 10 control patients (without CAUTI) possessing diabetes mellitus were included. The association was found to be statistically significant (p value 0.0008). The odds ratio was 4.09, signifying that those with

Table 3: Antibiotic sensitivity pattern of gram negative isolates

ANTIBIOTICS	E.coli n=23	Klebsiella spp n=13	Pseudomonas spp n=8	Citrobacters pp n=2	Proteus spp n=2
Ampicillin	5 (21.73%)	3 (23.07%)	--	1 (50.0%)	1 (50.0%)
Gentamicin	14 (60.87%)	8 (61.54%)	6 (75.0%)	2 (100%)	2 (100%)
Amikacin	18 (78.26%)	10 (76.92%)	6 (75.0%)	2 (100%)	2 (100%)
Ceftazidime	16 (69.57%)	11 (84.62%)	6 (75.0%)	2 (100%)	2 (100%)
Amoxicillin+ Clavulanic acid	7 (30.43%)	6 (46.15%)	---	0	0
Piperacillin+ Tazobactum	20 (86.96%)	9 (69.23%)	7 (87.5%)	2 (100%)	2 (100%)
Ceftriaxone	16 (69.57%)	8 (61.54%)	6 (75.0%)	2 (100%)	1 (50.0%)
Ciprofloxacin	14 (60.87%)	8 (61.54%)	2 (25.0%)	0	2 (100%)
Imipenem	23 (100%)	13 (100%)	8 (100%)	2 (100%)	2 (100%)
Norfloxacin	14 (60.87%)	8 (61.54%)	4 (50.0%)	1 (50.0%)	1 (50.0%)
Nitrofurantoin	19 (82.61%)	9 (69.23%)	--	2 (100%)	1 (50.0%)
Cotrimoxazole	10 (43.48%)	7 (53.85%)	--	2 (100%)	1 (50.0%)

diabetes mellitus had 4.09 times more risk of developing CAUTI than those without diabetes mellitus. Diabetes mellitus was found to be a risk factor for CAUTI by many studies.[18,15,19,20,21,6]

In our study population of patients affected with CAUTI, female patients were affected with CAUTI more than males. Thus, it is in corroboration with the similar studies that female sex was found to be a risk factor for CAUTI.[18,15,19,20,21,6]

In the present study, total 66 isolates were found where gram negative bacilli showed preponderance of CAUTI and E.coli was isolated from maximum number of CAUTI samples which are comparable with other studies In our study, the anti-fungal sensitivity was of no aim as most of the researches isolated candida in pure culture and mentioned as organisms, but did not provide its antifungal sensitivity. Even the study of Kamath et al., (2009) mentioned candida as a causative organism, and claim that the incidence is in agreement with other studies without mentioning antifungal sensitivity of Candida. Only the antibiogram of the gram positive and gram negative organisms were provided.[22,23,24,25,26,15,27,28,29,30,31,32]

CONCLUSION:

it is concluded that the old age, prolonged catheterization, presence of diabetes are the significant risk factors for CAUTI. Indwelling urethral catheters should be avoided whenever possible and should never be resorted to unless with absolute indications. Insertion of catheter should be done in strict asepsis by trained personnel. Before catheterization, perineal areas should always be cleaned using an antiseptic or germicidal preparation. Hand washing should be done

Table 4: Antibiotic sensitivity pattern of gram positive isolates

ANTIBIOTIC	CONS n=4	S. aureus n=3	Enterococcus spp n=4
Ampicillin	1 (25.0%)	1 (33.33%)	1 (25.0%)
Gentamicin	2 (50.0%)	2 (66.67%)	4 100
Penicillin G	2 (50.0%)	2 (66.67%)	2 (50.0%)
Cefoxitin	4 (100%)	3 (100%)	4 (100%)
Linezolid	3 (75.0%)	2 (66.67%)	4 (100%)
Vancomycin	4 (100%)	3 (100%)	4 (100%)
Ciprofloxacin	3 (75.0%)	2 (66.67%)	2 (50.0%)
Norfloxacin	2 (50.0%)	2 (66.67%)	3 (75.0%)
Nitrofurantoin	2 (50.0%)	3 (100%)	4 (100%)
Co-trimoxazole	2 (50.0%)	2 (66.67%)	2 (50.0%)
Tetracycline	2 (50.0%)	2 (66.67%)	2 (50.0%)

immediately before and after manipulation of catheter site or apparatus. Closed catheter drainage system should be employed in all cases. The entire system should be replaced in an event where a break is present. The catheter should be inspected frequently to ensure that no obstruction in flow of urine. Emphasis should always be placed on good catheter management rather than the use of prophylaxis to reduce the incidence of CAUTI.

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Research Article

Study of Serum Adiponectin, Insulin and Insulin Resistance in Offsprings of Diabetic Parents

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ABSTRACT

Adiponectin is an adipocytokine that is exclusively expressed and secreted from adipose tissue. Its role as a protective adipokine is suggested by low levels in states of insulin resistance (IR), cardiovascular disease (CVD) and type 2 diabetes (T2DM). In present study we compared serum adiponectin, insulin and (IR) in offspring's of diabetic and non-diabetic parents and showed if any significant difference is there between both the groups. Analytical cross-sectional study was carried out. Subjects were randomly selected based on inclusion and exclusion criteria aged between 18-30 years and grouped in three groups: Group 1: 60 off-spring of non diabetic parents; Group 2: 38 off-spring of single diabetic parents; Group 3: 22 off-spring of both diabetic parents. In all the groups fasting plasma glucose, serum insulin and serum adiponectin were estimated. Statistical analysis was carried out to compare values with group3. Mean values of serum adiponectin were Group 1(10.25µg/ml ±1.68) group 2 (9.25 µg/ml ±1.81) and group 3 (10.86 µg/ml ± 1.23), Fasting blood sugar mean value in group1 :(86.84mg/dl ± 6.25), group 2: (94.95 mg/dl ±6.58), group3: (85.23 mg/dl ±5.93), Insulin mean values in group1 (10.81µU/mL ±1.73), group2: (12.69 µU/mL ±1.55), group 3 (8.69 µU/mL ±2.55), Insulin resistance group1 (2.4±0.48), group2 (2.55±0.55), group3: (1.8±0.55). The values of all the three parameters were significantly different between three groups ($p < 0.01$). Serum level of adiponectin, insulin and insulin resistance were significantly different in offspring's of diabetic parents. Serum Adiponectin might play a key role in developing diabetes in near future.

KEY WORDS: adiponectin, cardiovascular disease (CVD), insulin resistance (IR),

INTRODUCTION:

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both and is associated with long-term damage, dysfunction and failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels.[1] Type 2 diabetes is increasing all over the world due to population growth, aging, urbanization and an increase of obesity and physical inactivity.

In India, more than 62 million people are diagnosed as diabetic which will rise to 87.0 million by 2030.[2]It has been reported that diabetes is disproportionately high in young to middle aged adults which could have long lasting adverse effects on a nation's health and economy.[3, 4]First degree relatives of patients with type 2 diabetes frequently show abnormal glucose tolerance and have a 30% - 40% risk of developing type 2 diabetes themselves. [5]

Adiponectin, is a novel peptide expressed specifically and abundantly in adipose tissue.[6-7] Adiponectin is a 244 a.a. protein that regulates the metabolism of lipids and glucose. Adiponectin decreases insulin resistance and body weight by increasing lipid oxidation in muscle and other organs such as the pancreas and liver [8]. Plasma Adiponectin concentrations are also reduced in individuals with obesity, diabetes mellitus, or coronary heart disease[9] .

It seems to be the most interesting and promising biologically active molecule released from fat cells which has profound protective actions in the pathogenesis of diabetes mellitus and cardiovascular disease.

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There are few studies which have shown hypo-adiponectinemia is associated with family history of diabetes[10, 11] but not all[12, 13].Purpose of this study was to investigate any significant difference in the level of total serum adiponectin and their association with fasting insulin, glucose and insulin resistance in offspring of diabetics.

MATERIALS AND METHODS:

Analytical cross sectional study was carried out after the approval by Institutional ethics committee of People's College of Medical Sciences & Research Center, Bhopal. Written consent was taken from all participants.Total 120 subjects in which 60 normal healthy offspring of diabetic parents and 60 normal healthy offspring of non-diabetic parents between age group of 18 to 30 years were enrolled after applying all inclusion and exclusion criteria. All socio-demographic data of the participants were entered in a self-designed proforma.

Inclusion criteria:

1. Normal healthy off-springs of diabetic parents in age group 18 to 30 yrs.
2. Normal healthy off-springs of non-diabetic parents in age group 18 to 30yrs.

Exclusion criteria:

1. Subjects not fulfilling the age criteria mentioned in inclusion criteria.
2. Any acute illnesses, such as infection, surgery, and hospital admission (as obtained from history).
3. Subjects with fasting blood sugar level >110 mg/d

Participants were divided into three groups:

Group 1: control group consists (n=60) both male and female of age group between 18 to 30 years, whose parents are non-diabetic.

Group 2: (n=38) both male and female of age group between 18 to 30 years, with one of their parents having history of type 2 diabetes.

Group 3: (n=22) both male and female of age group between 18 to 30 years with both parents having history of diabetes.

Weight and height were measured. BMI was evaluated as weight divided by height squared (kg/m²). Waist circumference was measured at a level midway between the lowest rib margin and the iliac crest. Hip circumference was measured at the widest point over the buttocks. WHR (waist hip ratio) were calculated as waist circumference divided by hip circumference.

After overnight fasting (8-12 hrs.) blood sample for plasma glucose was collected in fluoride vial for blood sugar and that of insulin and adiponectin were collected in plain vial between 8 am-10 am.

Sample was centrifuged; serum was separated and immediately stored in deep freezer at -20˚C until further analysis.

Serum Glucose was measured by commercial kits for Bio system A25 fully auto analyzer. The plasma insulin and serum Adiponectin was analyzed by using ELISA method. Insulin resistance was estimated using HOMA-IR based on fasting plasma glucose (FPG) and fasting plasma insulin (FPI) concentrations. Which is defined as follows: FPI (μU/mL) × (FPG [mg/dl] x 0.055/22.5).[14]

STATISTICAL ANALYSIS:

In the current study we calculated mean value of serum adiponectin, insulin and insulin resistance in 3 groups. Comparison between the groups was done by applying ANOVA and Post hoc analysis.Multiple regression was performed to see the correlation between adiponectin and other biomarkers keeping the adiponectin as dependent variable. The collected data was analyzed by SPSS 20 version with assistance from a qualified statistician. p value<0.05 were considered significant difference.

RESULTS:

In our study we found significant difference between mean values of Fasting blood Glucose in 3 groups (Group1- 86.84 mg/dl ± 6.2, Group 2-94.95 mg/dl ± 6.5, Group3- 85.23 mg/dl ± 5.9; p = 0.000**). The mean value of Fasting Blood Sugar was higher in offspring of both diabetic parents than offspring of single diabetic parent and the difference was highly significant (p=0.000**). The mean value of Fasting Blood Sugar was higher in offspring of both diabetic parents than offspring of non-diabetic parent and the difference was also statistical significant (p=0.000**). There was no statistical significant difference in mean value of Fasting Blood Sugar between offspring of single diabetic parent and offspring of non-diabetic parent (p= 0.421) (Table 1 and Table 2).

There was a significant difference between mean values of Serum Insulin in all groups (Group1- 10.81 μU/mL ± 1.7, Group2- 12.7 μU/mL ± 1.5, Group3-8.69 μU/mL ± 2.5; p=0.000**). The mean value of Serum Insulin was Higher in offspring of both diabetic parents than offspring of non-diabetic parent and the difference was statistical significant (p=0.000**). The mean value of Serum Insulin was

Table 3: Correlation between Serum Adiponectin and other biomarkers using Multiple Regression Analysis

Variable	Unstandardized Coefficients		Standardized Coefficients	R	Sig.
	B	Std. Error	Beta		
BMI	-0.368	0.027	-0.761	-13.608	<0.0001*
W/H ratio	-2.949	1.657	-0.097	-1.780	0.078
FBS	-0.026	0.012	-0.116	-2.175	0.032*
Insulin	-0.134	0.041	-0.221	-3.278	0.001*
Insulin resistance	-0.088	0.172	-0.034	-0.513	0.609

[* p value <0.05(significant), ** p value <0.01 (highly significant)]

higher in offspring of both diabetic parents than (Group1- 1.8 ± 0.5, Group2- 2.4 ± 0.4, Group3- 2.5 ± 0.5; p= 0.000**). The mean value of Insulin Resistance was higher in offspring of both diabetic parents than in offspring of non-diabetic parent and the difference was statistical significant (p=0.000**). The mean value of Insulin Resistance in offspring of single diabetic parent was higher than in offspring of non-diabetic parent which was found to be highly significant (p=0.000**).The mean value of Insulin Resistance was higher in offspring of both diabetic parents than offspring of single diabetic parent but the difference was not statistical significant (p=0.566) (Table 1 and Table 2).

For these 3 groups the mean values of serum adiponectin (µg/ml) were compared (Group1- 10.25 µg/ml ± 1.68, Group2 - 9.25 µg/ml ± 1.81, Group3- 10.86 µg/ml ± 1.23) and this difference was highly significant. The mean value of serum Adiponectin was lower in offspring of both diabetic parents than offspring of single diabetic parent and offspring of non-diabetic parents. The difference between group 3 and group 1 was statistical significant (p=0.000**). However, the difference between group 3 and group 2 was also statistical significant (p=0.039*). The mean value of Serum Adiponectin was lower in offspring of single diabetic parent than offspring of non-diabetic parents but the difference was found to be statistically non significant (p=0.124) (Table 1 and Table 2).

Table 3 shows correlation of adiponectin with other parameters using multiple regression analysis. The value of serum adiponectin was negatively correlated with BMI, Waist hip ratio, FBS, Serum Insulin and insulin resistance. Negative correlation means increase in value of Serum adiponectin was associated with decrease in values of BMI, Waist hip ratio, FBS and Serum Insulin and insulin resistance. The correlation between serum adiponectin and BMI, FBS, and serum insulin was statistical significant (p< 0.05) but that with W/H ratio and insulin resistance was statistically insignificant.

DISCUSSION:

Type 2 diabetes is a metabolic syndrome which is relatively common in most countries including India which is now being referred to as "Diabetes Capital of the world" and risk of becoming diabetic for individual increases by two to four times if he has positive family history. Adiponectin is a new marker which is found associated with type 2 diabetes however it is not clear whether it is associated with family history of diabetes.

In the current study we measured fasting blood glucose, serum insulin, BMI, Waist Hip ratio, serum Adiponectin and through mathematical model for insulin resistance HOMA-IR in the first degree relatives of diabetes patient and tried to assess the association of adiponectin in future onset of diabetes.

Although in our study the fasting blood glucose level in all the three groups was within normal range but we found highly significant difference observed in mean value of blood glucose between offspring of both diabetic parents and offspring of non diabetic parent (p=0.000**). There was also highly significant difference between offspring of both diabetic parents and offspring of single diabetic parent (p=0.000). In support with our study Shahid et al [15] also found significantly higher level of fasting blood glucose in offspring of both diabetic parents compared to offspring of single and offspring of non-diabetic parents.

Table 1: Mean value ±SD serum adiponectin and other biomarkers in study groups

Parameters	Group 1 (n=38)	Group 2 (n=22)	Group 3 (n=60)	p Value
Fasting blood Glucose (mg/dl)	85.23 ± 5.9	86.84 ± 6.2	94.95 ± 6.5	0.000**
Fasting serum Insulin (µU/mL)	8.69 ± 2.5	10.81 ± 1.7	12.7 ± 1.5	0.000**
HOMA-IR	1.8 ± 0.5	2.4 ± 0.4	2.5 ± 0.5	0.000**
Adiponectin (µg/ml)	10.86 ± 1.2	10.25 ± 1.7	9.25 ± 1.8	0.000**

[* p value <0.05(significant), ** p value <0.01 (highly significant)] HOMA-IR- Homeostasis model assessment-insulin resistance)

Table 2: Comparison between 3 groups using Post hoc analysis of ANOVA test

Variable	A	B	Mean Difference (A-B)	Std. Error	Sig.
Serum Adiponectin µg/ml	Group 1	Group 2	0.61333	0.31137	0.124
		Group 3	1.60879 *	0.37433	0.000**
	Group 2	Group 1	-0.61333	0.31137	0.124
		Group 3	0.99545 *	0.40235	0.039*
	Group 3	Group 1	-1.60879 *	0.37433	0.000**
		Group 2	-0.99545 *	0.40235	0.039*
Serum Insulin (µU/mL)	Group 1	Group 2	-2.12175 *	0.44782	0.000**
		Group 3	-3.99424 *	0.53837	0.000**
	Group 2	Group 1	2.12175 *	0.44782	0.000**
		Group 3	-1.87249 *	0.57867	0.004**
	Group 3	Group 1	3.99424 *	0.53837	0.000**
		Group 2	1.87249 *	0.57867	0.004**
Insulin Resistance	Group 1	Group 2	-0.6060 *	0.1105	0.000**
		Group 3	-0.7515 *	0.1329	0.000**
	Group 2	Group 1	0.6060 *	0.1105	0.000**
		Group 3	-0.1456	0.1428	0.566
	Group 3	Group 1	0.7515 *	0.1329	0.000**
		Group 2	0.1456	0.1428	0.566

[* p value <0.05(significant), ** p value <0.01 (highly significant)] (Group 1- offspring of non-diabetic parents, Group 2- offspring of single diabetic parent, Group 3 - offspring of both diabetic parents)

offspring of single diabetic parent which was highly significant statistically (p=0.004**). The mean value of Serum Insulin was higher in offspring of single diabetic parents than offspring of non-diabetic parent and the difference was statistical significant (p=0.000**).

A highly significant difference between mean values of insulin resistance was found in all groups

Although we did not found any case of diabetes in the offspring, we found highly significant difference in mean value of blood glucose between offspring of both diabetic parents and offspring of non-diabetic parent (p=0.000**). As reported by Lihn et al [16] at baseline the subjects of his study, and in which they describe that those patients, who progressed to diabetes, increased their levels at a rate of 2.27mg/dl per year. So probability of developing diabetes at later stage in these group will be more.

In our study we found significantly higher level of Serum Insulin in offspring of both diabetic parents than offspring of non-diabetic parent (p=0.000**) and also Serum Insulin was significantly higher in offspring of both diabetic parents than offspring of single diabetic parent (p=0.004**).The mean value of Serum Insulin was also significantly higher in offspring of single diabetic parents than offspring of non-diabetic parent (p=0.000**).

Higher insulin levels in the offspring of both diabetic parents were consistent with studies referred by costa et al [17] basal insulin levels were higher in normo-glycemic first degree relatives (2.4 ± 0.4 μU/ml) than corresponding values in control (2.1 ± 0.6 μU/ml).Adeela Shahid et al [15] also found significantly higher level of insulin concentration in offspring's of both diabetic parents compared to non-diabetic parents.

It is known that type 2 diabetes frequently shows a resistance to the effect of insulin. [18]Although the etiology is not clear, there is no autoimmune destruction of the beta cell in type 2 diabetes. Researches carried out on family members with diabetes and twins with diabetes confirmed that hereditary factors play a role in type 2 diabetes.

We estimated Insulin resistance by HOMA-IR which has been shown to correlate well with clamp methods, we found that IR was significantly high in offspring's of both diabetic parents compared to offspring of non-diabetic parents (p=0.000**). The mean value of IR was also significantly higher in offspring of single diabetic parent compared to the value in offspring of non-diabetic parents (0.000**).

Insulin resistance and defective insulin secretion are considered to be the most important events in the development of NIDDM, and insulin resistance would represent a genetic determinant of NIDDM study population. [19-21]

We found that the mean value of serum Adiponectin was significantly lower in offspring of both diabetic parents than offspring single diabetic parent (0.039*) and offspring of non-diabetic parents (0.000**).In comparison with our study ,Pellme F et al [22] and Sull et al[23]also found that family history of diabetes is associated with hypo-adiponectinemia.

Lindsay et al [24] recently showed in a case-control study with Pima Indians that higher plasma levels of adiponectin protected against later development of type 2 diabetes.

Lihn et al[16] found that adiponectin expression in adipose tissue is reduced in first degree relatives. He found substantially reduced levels of adiponectin mRNA in subcutaneous adipose tissue from first degree relatives compared with control subjects.

To find correlation of serum adiponectin with other parameters we applied multiple regression analysis. We found that serum adiponectin was inversely correlated with BMI and was significant but correlation with WHR was not significant. Our findings are consistent with Indian studies reported by researchers Vikram et al [25] found that adiponectin levels correlate (inversely) strongly with anthropometric parameters in Asian-Indians though unlike their study, our study does not show a strong correlation with WHR.

In our study serum adiponectin concentrations also inversely correlated with fasting blood glucose and insulin which is consistent with other studies referred by Bacha et al [26], and recently Bose et al [27] who also showed negative correlation of serum adiponectin with insulin.

Plasma adiponectin levels were inversely correlated with fasting glucose and insulin study done by Hotta k et al[9],Weyer C[28].

Comuzzie AG et al [29] in his study that Adiponectin levels reported genetic heritability of 46%. Genetic polymorphisms in the adiponectin gene have been identified [30, 31] and shown to be associated with obesity and insulin resistance. [32] Yet, the mechanism by which adiponectin influences insulin sensitivity in humans is unclear.

The main limitation of this study is that it is a cross-sectional study. In our study we had taken the sample from medical and dental students. Thus our study shows sample bias and findings do not represent the community. As the rates of the variables under study are fairly high in the community, our sample size was small. To generalize the findings a larger population study needs to be carried out.

CONCLUSION:

These observations suggest that increased circulating adiponectin values may serve as a useful marker of predisposition to type 2 diabetes among

offspring of diabetic parents. We suggest further studies an important marker in larger samples at various centers at national and international level so that exact role of serum adiponectin as a screening tool for type 2 diabetes in vulnerable population could be established.

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Research Article

Iron Deficiency as a Risk Factor for Febrile Seizures – A Case Control Study

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ABSTRACT

Febrile seizure (FS) is a common cause of seizure in young children and occurring in 3-4% children under 5 years of age. Iron deficiency is reported as commonest micro-nutritional deficiency worldwide and has been associated with febrile seizures. The aim is to evaluate role of Iron deficiency as a risk factor of febrile seizure. A total of 170 children (6m – 5 years) were included in the study. 70 cases had febrile seizure as defined by International League Against Epilepsy and rest 100 controls had short history of febrile illness (< 3 days) without seizures. Anemia was defined as decrease of the Hb <11gm%, and serum ferritin <12ng/ml. Discrete variables are expressed as counts (%) and compared using the Chi-square tests, Adjusted odds ratios and Statistical significance is set at $p < 0.05$.

In the present study, 34.3% cases belong to 6-16 months age group and male to female ratio in cases was 1.69:1. 65.7% of cases and 45% of controls were iron deficient. On correlating iron deficiency with gender, male preponderance was observed in children with febrile seizure. The study observed 65.7% cases of FS had iron deficiency as compared to 45% of control group. (OR-2.34; $p<0.05$). Also, there was statistically significant association between recurrence of FS and iron deficiency. Early detection and timely correction of iron deficiency may be helpful for prevention of febrile seizures in children of this age group.

KEY WORDS: febrile seizure, iron deficiency, heamoglobin, s.ferritin

INTRODUCTION:

Febrile Seizures (FS) are most common cause of seizure in young children, and perhaps one of the commonest pediatric emergencies worldwide, occurring in 3-4% of children under the age of 5 years.[1] Although FS is benign and rarely leads to brain damage, it causes emotional, physical, and mental damages, which are stressful for parents, and affects families' quality of life.[2,3] Earlier Indian studies suggested that up to 10% of children experience a febrile seizure, though recent data indicate that the incidence rate in India is similar to western figures.[4,5] Iron deficiency (ID) is reported as commonest micro-nutritional deficiency worldwide (30%) especially in developing countries and is a preventable and treatable condition.[6] Iron deficiency reduces the metabolism of some neurotransmitters, such as monoamine and aldehyde oxidase[7,8] and thus it may alter the seizure threshold of a child.[9,10] Iron deficiency is postulated as a risk factor for febrile seizures in children and it is an easily correctable condition.[11,12]

Hence, the current study is carried out to evaluate the relationship between iron status and febrile seizures, if any.

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MATERIALS AND METHODS:

This is a descriptive-analytical case control study done in the inpatient department of the Department of Pediatrics People's College of Medical Sciences & Research Centre during November 2011 to April 2013. Ethical clearance was obtained for the study from the Institutional Research Advisory Committee and Institutional Ethics Committee. Cases were children of age group 6 months to 5 years presenting with simple febrile seizures to the Pediatrics Emergency Department and wards of the hospital during the study period. Diagnostic criteria for simple febrile seizures according to the International League against Epilepsy (1993) defines febrile seizure as a seizure occurring in childhood

between 3 month and 5 years of age, associated with a febrile illness not caused by an infection of the CNS, without previous neonatal seizures or a previous unprovoked seizure and not meeting criteria for other acute symptomatic seizures.[13]

Consecutive cases were selected for the study and concurrent controls were selected from the same setting and included febrile children of age group 6 months to 5 years who presented with short duration fever (<3 days) but without seizures.

Children presenting with afebrile seizures, history of seizure disorder, previous afebrile seizures, CNS infections, metabolic imbalance, developmental delay, neurological deficit, Iron supplementation for more than 3 days in last 6 months, previously diagnosed cases of other hematological problems like hemolytic anemia, bleeding or coagulation disorders, hematological malignancies were excluded from the study. After informed consent, detailed history was elicited and physical examination was done. Cases of anemia due to other causes were excluded on the basis of exclusion criteria mentioned earlier. At the time of enrollment - detailed history and physical examination were recorded on the performa. Blood samples for Hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), Red Cell Distribution Width (RDW) and plasma ferritin were collected for each patient. Blood investigations were done using an automated hematology analyzer (Mindray BC-3000Plus). Plasma Ferritin level was measured by using the ELISA method for quantitative determination of human Plasma Ferritin. Anemia was defined as decrease of the Hb <11gm%, and serum ferritin <12ng/ml (WHO).[6] Data were entered in MS Excel, cleaned and completeness checked. Analysis was done using SPSS Version 13. Discrete variables were expressed as counts (%) and compared using the Chi-square tests, Adjusted odds ratios and Statistical significance is set at $p< 0.05$.

RESULTS:

A total of 170 children (6m – 5 years) were included in the study. 70 cases had febrile seizure as defined by International League Against Epilepsy and rest 100 controls had short history of febrile illness (< 3 days) without seizures. In the present study, there were 44 males among cases and 60 males among controls. 26 females were present in case group as compared to 40 females in control group. This implies uniform distribution of children among the cases and controls according to gender. In age group distribution, 34.3% cases belong to 6-16 months age group and similarly control group has maximum number (35%) in this age group. The male to female ratio in cases was 1.69:1 and in control group was 1.5:1. On evaluation for Iron defciency, 65.7% of cases and 45% of controls were iron deficient. On correlating iron deficiency with gender, male preponderance (72.7%) was observed in children with febrile seizure against 41.6% iron deficient males in control group. On correlating iron deficiency with prevalence of febrile seizures, we observed that 65.7% cases of FS had iron deficiency as compared to 45% of control group. (OR-2.34; $p<0.05$) (Table 1). When correlating Iron deficiency with various demographic factors, a positive association has been found with male gender and lower socio-economic status. There is statistically significant association between recurrence of FS and iron deficiency (Table 2). However, no statistical correlation was observed for type of febrile seizure and iron deficiency.

DISCUSSION:

In the present study, The mean age of children with febrile seizures in our study is 28.41 months. The incidence of febrile seizure in <3 years was higher (78.5%) as compared to >3years age groups (21.5%). Hartfield et al[14] reported maximum cases in the age group less than 24 months and mean age of 17.9 months. Kumari et al[15] reported 55.8% of cases and 56.5% of controls were in the age group less than 17 months. Higher prevalence of febrile seizure in younger age group could be because of immaturity of the brain as maximum hippocampal growth is noted to occur in the period 15-36 months, this is the period of normal brain maturation which is thought to have enhanced neuronal excitability[16].

In the present study there was male preponderance, which is similar to previous studies[14, 15]. Whether there is a biological basis for the gender-specific differences in febrile seizure susceptibility, or whether boys just contract more fevers and therefore are at greater risk, is currently not established.

On correlating prevalence of FS with SES, present study shows majority of children of FS belong to lower SES (65.7%) in contrast to control group where maximum children belong to middle SES. This difference was statistically significant with Odds Ratio 3.16 ($p=0.008$). The plausible explanation could be that children belonging to LES are more prone to acute febrile illnesses, which predisposes them to higher chances of developing FS. Kumari et al[15] also found similar results where 115 of 154 cases belonged

Table 1: Iron Deficiency in Cases and Controls

	Cases(70)			Controls(100)			Odds ratio	p value
	No.	% of cases	% of iron deficient children	No.	% of controls	% of iron deficient children		
Iron deficient	46	65.7	50.5	45	45.0	49.5	2.3426	0.0082
Not deficient	24	34.3	30.3	55	55.0	69.6		

χ^2=7.103, p value = 0.008, , d.f. =1

Table 2: Correlation of iron deficiency with first and past history of febrile seizure

	Iron deficient (%)	Z Value	p value
First seizure (48)	27(56.2)	2.45	0.0143
Seizures in past (22)	19(86.3)		

χ^2= 6.570, p value = 0.037, d.f. =1

to lower socioeconomic status. This coincides with results of previous studies where lower socio-economic status has been a risk factor for febrile seizures.

Iron deficiency was found as a significant risk factor for simple febrile seizures in children of age group 6 months to 5 years in our study. In the study done by Pisacane, et al[17] among children of the same age group, similar results were noted and the odds ratio was 3.3 (95% CI of 1.7-6.5).

In present study iron deficiency was identified as a risk factor for febrile seizure with Odds ratio of 2.346 (p=0.0082). This has been very similar to prior studies[15,17] relating iron deficiency with febrile seizure as a modifiable risk factor.

Daoud et al[18] observed a significantly lower ferritin level in the first febrile seizures group than in the reference group proving that serum ferritin is a sensitive, specific and reliable measurement for determining iron deficiency at an early stage, and it may be the best indicator of total body iron status. Vasvani et al[19] observed significant low serum ferritin levels in children with FFS than in controls. On the contrary, few studies[20,21] found no significant difference in serum ferritn level between the two groups.

On correlation of iron deficiency with number of FS, we observed that, there is statistically significant association between recurrence if FS and iron deficiency (z =2.45; p=0.0143) indicating iron deficiency as a risk factor of recurrence of febrile seizure. Though on correlation of iron deficiency with frequency of FS, no significant association was found

The type of FS and iron deficiency were also correlated, where no statistically significant correlation was found. We found that, majority of cases were simple febrile seizures, out of which 64.5% were iron deficient and 75% of complex febrile seizures were iron deficient. In a similar study by Aliabad et al[22] reported 86% cases to be of simple febrile seizures and 14% of complex FS.

The strength of current study included standardized criteria for diagnosing febrile seizures, and iron deficiency, concurrent enrollment of controls and cases, and no recall bias regarding exposure. The limitation of the study being a hospital-based study the prevalence of exposure and outcome variables may be different from a community setting. Serum ferritin, a nonspecific acute phase reactant can rise in any inflammatory conditions, although both cases and controls were having fever at the time of enrollment.

A strong correlation exists between iron deficiency and febrile seizure. Early detection and timely correction of iron deficiency may be helpful for prevention as well as recurrence of febrile seizures in children of this age group.

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Research Article

Evaluation of Oxidative Stress in Malnourished Children at Nutritional Rehabilitation Centre of Bhopal

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ABSTRACT

The aim of this study was to evaluate the effect of oxidative stress in severe acute malnourished children. Serum Malondialdehyde (MDA), vitamin C and serum zinc were determined in 60 severe acute malnourished children (age 6 months - 5 years) and sixty age and gender matched healthy controls. Mean serum MDA was found to be significantly raised and serum vitamin C and zinc were significantly decreased in malnourished children as compared to healthy controls. A significant positive correlation was found between vitamin C and zinc and negative correlation between vitamin C and MDA. From the present observations, it is evident that stress is created as a result of deficiency of nutrients in severe acute malnourished children. This stress leads to production of excess reactive oxygen species (ROS).These ROS lead to lipid peroxidation and consequent formation of MDA.

KEY WORDS: malnutrition, MDA, oxidative stress, vitamin C

INTRODUCTION:

In a developing country like India, Protein energy malnutrition constitutes one of the major nutritional and health problems in children under five years of age. It has a significant contribution to the mortality and morbidity in this age group of children. World Health Organization (WHO) defines malnutrition as 'the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions'.[1]

Malnutrition is one of the largest factors suppressing India's spectacular growth. With vast forests and several of India's famous game parks, Madhya Pradesh is geographically the second largest state in India and has a population of about 72 million (provisional figure, Census 2011). There are a large number of tribal communities here and almost 40 per cent of the state's inhabitants live below the poverty line, many in rural areas where they subsist on tiny farm plots. While high rates of malnutrition, child and maternal mortality have challenged this state, UNICEF and the State Government are making a positive impact with a range of programs. These include training thousands of village health workers to recognize and treat sick babies, and encouraging women to rest and eat well-balanced meals during pregnancy. New hospital units for sick newborns are also saving lives. Hence, there is need to understand the nature of antioxidants and their resultant benefits in the larger interest of the deprived population of developing countries. Its worth noting that the free radicals are very short lived and unstable, so they are difficult to measure. However, their detrimental effects can be measured by estimating their by-products. Marker of oxidative stress is MDA, a by-product of lipid peroxidation.[2] This oxidative stress has to be counteracted by antioxidants. Capacity of body to defend itself from free radicals can be measured by assessing the blood levels of antioxidant micronutrients zinc and ascorbic acid and also endogenous antioxidants such as albumin and bilirubin.[3,4] Zinc plays a critical role in the functioning of metalloenzymes including Zn-superoxide dismutase, which plays an important role in antioxidant defence mechanism. Lipid peroxide radicals formed by peroxidation of polyunsaturated fatty acids react with vitamin E to form tocopheroxy

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radical which is reduced back to tocopherol by reaction with vitamin C from plasma.[5] Thus vitamin C forms an important antioxidant of aqueous phase.

MATERIALS AND METHODS:

The study was conducted after the approval of ethical committee, in the Department of Biochemistry and Paediatrics at People's College of medical Sciences & Research Center, Bhopal. The research protocol was in agreement with the Helsinki declaration. The present study included 120 children between the age of 6 months to 5 years with the help of Paediatrician. Out of 120, sixty children were diagnosed and suffering from severe acute malnutrition according to the diagnostic criteria proposed by WHO[6] and admitted to the nutritional rehabilitation centre, PCMS & RC. Sixty samples of healthy children were taken as controls. The controls were age and gender matched to cases, with ratio of case to control was 1:1.

Inclusion and exclusion criteria: Severe acute malnourished children having no clinical evidence of any infectious disease at the time of blood collection were taken as subjects. Children taking antioxidant supplements were excluded from the study.

Informed consent was taken from parents of study participants. Random blood samples. Five ml of venous blood was withdrawn from each subject and collected in plain bulb and allowed for spontaneous blood clotting for 20-30 minutes. Then the samples were centrifuged at 3000 rpm for 10 minutes at room temperature to separate serum from blood cells. The separated sera was stored at - 20^0C in eppendorf tube vials until assay. The analysis of all parameters was done using chemicals and reagents of analytical grade. Spectrophotometer was used for the measurement of the parameters like malondialdehyde, vitamin C and zinc. Malondialdehyde was measured by thiobarbituric acid reaction[7] serum ascorbic acid by Ayekyaw method[8] and serum zinc by colorimetric method.[9]

RESULTS:

Statistical analysis was carried out using SPSS software, version 20. The results were expressed as mean±SD. Student 't' test was applied for statistical analysis,p value ($p<0.001$) were considered as highly significant.The observations and inference obtained from this study were summarized in the following tables.

Table no.1 shows significantly elevated ($p<0.001$) levels of antioxidants Vitamin C and zinc in healthy controls as compared to SAM patients. While a significantly increased levels of MDA is noticed in SAM patients $p<0.001$ as compared to healthy controls. Table 2 shows that vitamin C and zinc are positively highly correlated while vitamin C AND MDA are negatively correlated r=-0.503 in cases and r=-0.849 in controls.

DISCUSSION:

In the present study malnourished children were found to have less antioxidant levels and raised levels of products of oxidative damage.

Table 1: Indices of oxidative stress and antioxidant among Controls and Patients

Parameters	Controls (Mean±SD)	Severe acute malnourished patients (Mean±SD)	p value
	n = 60	n = 60	
MDA (nmol/ml)	1.59±0.24	2.98±0.60	<0.001*
Vitamin C (mg/dl)	1.62±0.32	0.46±0.04	<0.001*
Zinc (µg/dl)	105±11.56	53.10±4.33	<0.001*

(* Highly significant, $p<0.001$)

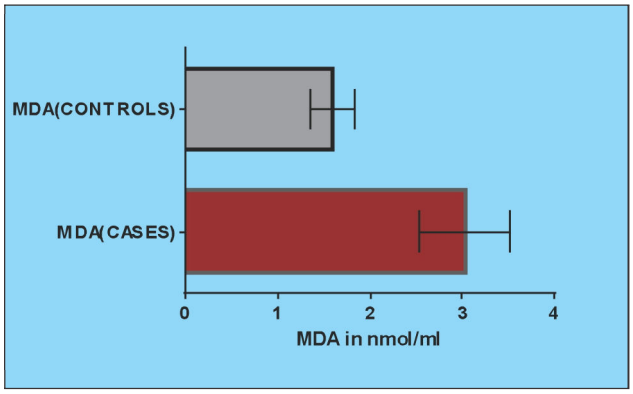
Table 2: Correlation analysis: (a) Vitamin C and MDA, (b) Vitamin C and Zinc level.

	MDA	Zinc
Controls (n=60)	-0.849	0.909
Cases (n=60)	-0.503	0.969

(Correlation is significant at the 0.001 level)

Malondialdehyde (MDA), a product of lipid peroxidation is generated in excess amounts.[10,14] This oxidative stress and a possible consequential accelerated apoptosis may contribute to pathophysiology of malnutrition. A significant increase in the level of MDA in malnourished as compared to controls indicates the occurrence of lipid peroxidation.

Graph1:Mean MDA levels in Cases as Compared to controls.



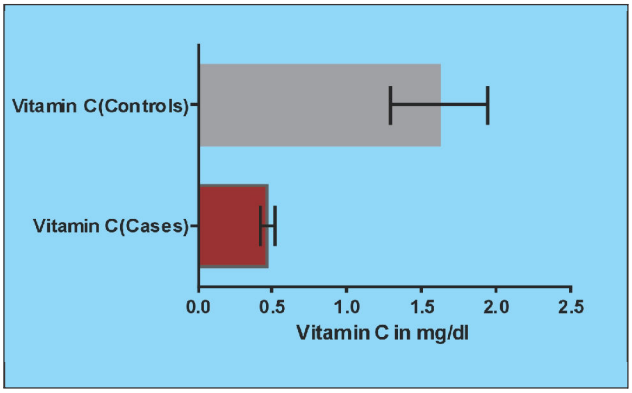
Lipid peroxidation leads to loss of membrane fluidity and integrity. Loss of membrane integrity, in case of mitochondria, undermine the efficiency with which the electron transport chain converts reducing equivalents to ATP, thus further aggravating the adverse effect of already reduced energy intake in malnourished children. The high levels of MDA are in agreement with those of other studies carried out by Khare[2] Perampalli,[10] Bosnak[11] and Ghone et al.[12]

Ferhat Catal et al (2007) & Jain Anuradha et al (2008) reported that significantly increased level of serum MDA in patients with malnutrition as compared to controls. In such condition, depletion of endogenous antioxidants may be expected.[15] A peroxidative damage of lipids is indicated by the increase in serum MDA levels. Among the many peroxidative effects of Nitric Oxide (NO), protein modification by nitrosylation or oxidation of -SH groups has been reported.[16] NO plays an important role in regulation of vascular tone and endothelial function, with respect to pathophysiology of malnutrition.

The body has developed several endogenous antioxidant defense systems which includes enzymes, minerals and vitamins. Particularly, vitamins C and E are non enzymatic endogenous antioxidant also exist within normal cells and react with free radicals to form radicals themselves which are less reactive than the radicals. They break radical chain reactions by trapping peroxyl and other reactive radicals.[17]

In the present study it was found that serum vitamin C status was found to be markedly low in malnourished children. It is an antioxidant vitamin which is used up to convert tocopheroxy radical to tocopherol whichbreaks the chain of lipid peroxidation and traps free radicals thus preventing oxidative damage.Depleted vitamin C levels have been supported by studies of Khare et al[2] and Ashour et al.[14]

Graph 2: Mean vitamin C levels: A comparison between Cases and Controls.

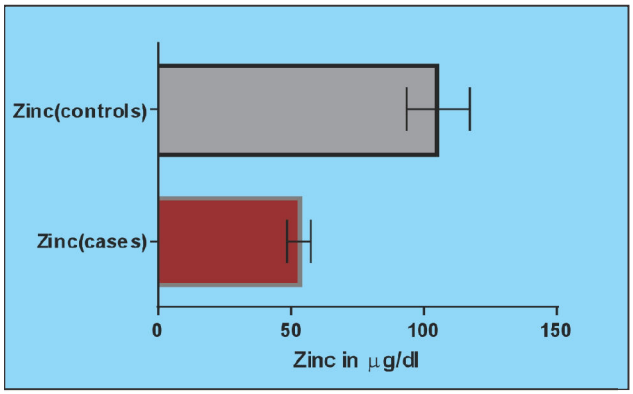


Zinc is the second most abundantly distributed trace element in the body after iron. Zinc catalyzes enzyme activity, contributes to protein structure, and regulates gene expression. Zinc deficiency caused by malnutrition is the 11th major risk factor in the global distribution of disease burden and is associated with 1.8 million deaths annually. Preliminary research correlated zinc levels with poor growth in children with malnutrition.[19,20]

In the present study, Serum zinc was found to be significantly lowered in malnourished children as compared to that in healthy controls.

Similar results have been found in the studies of Ghone et al[12],jain et al.[14] The effect of decreased zinc concentration is decreased activity of zinc dependent enzymes like lactate dehydrogenase, glutamate dehydrogenase, alkalinephosphatase, thymidinekinase. Thus zinc has a profound effect on protein ,energy and nucleic acid metabolism. So its deficiency can restrict cell proliferation. This could be acause of stunted growth in malnourished children. Superoxide dismutase is involved in scavenging of free radicals. There are two isoenzymes of SOD-Cu/Zn-SOD and Mn-SOD. Reduced zinc could be partly responsible for the decreased antioxidant activity of this enzyme and consequently increased

Graph 3: Mean Zinc levels in cases as compared to controls



oxidative stress.[2,12] Zinc has been shown to play a central role in the functioning of cells mediating non-specific immunity, such as neutrophils and natural killer cells and is needed for specific immune responses ,such as T- helper cell function.[21] Reduced immunity and increased susceptibility to infections in malnourished children could be the effect of reduced zinc. A recent animal study suggests that supplementation of protein and zinc rich food leads to improved immunity.[22]

Significantly lower level of antioxidants like vitamin c, zinc and increased oxidative stress in in the form of MDA suggests that failure of antioxidant defense mechanism against oxidative stress may be an important factor in the pathogenesis of malnutrition.

CONCLUSION:

Based on this study, there is reasonable evidence for oxidative stress in severe acute malnourished children. The antioxidant levels are decreased in an attempt to combat the increased oxidative stress. Therefore, appropriate use of antioxidants may be helpful in controlling the lesions in the patients of severe acute malnutrition. There is ample scope to conduct further studies for identifying the natural resources, which may be used in the dietary plans of especially malnourished children, through the established chains of public health interventions by government, semi government and private health care providers.

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Research Article

Role of Dexmedetomidine as an Anesthetic Adjuvant in Laparoscopic Surgery

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ABSTRACT

Dexmedetomidine is a highly selective α_2 agonist with properties of sedation, analgesia and anxiolysis, making it an ideal anesthetic adjuvant. Using an anesthetic adjuvant decreases the requirement of anesthetics and analgesics. We studied 60 patients of ASA grade I and II, aged between 18 to 50 years, of either gender posted for laparoscopic surgeries under general anesthesia. Patients were randomly allocated in one of the two parallel groups containing 30 patients each. Group D received Dexmedetomidine infusion at the rate of 1 mcg/kg for 20 minutes and then maintenance infusion of 0.2 mcg/kg/min till extubation. Control group NS received normal saline. Induction with propofol and fentanyl was carried out. Patients were monitored with standard monitoring. A reduction in the induction dose of propofol was observed, with a 30% less end-tidal concentration of isoflurane requirement for maintenance of anesthesia. Dexmedetomidine a highly selective alpha 2 agonist is an effective anesthetic adjuvant that can be safely used in laparoscopy.

KEY WORDS: anesthetic adjuvant, dexmedetomidine, laparoscopic surgery

INTRODUCTION:

Dexmedetomidine (Dex) has recently been added to the anesthesia armamentarium. It belongs to the class of α_2 agonists and possesses the properties of sedation, analgesia and opioid sparing effect. It differs from clonidine in being 16 times more specific for α_2 receptors.[1] Laparoscopic surgeries under general anesthesia are associated with hemodynamic changes in the form of increased systemic vascular resistance which leads to hypertension, forcing the anesthesiologist to increase the depth of anesthesia (DOA), and at times even requires the use of vasodilators to control the rising blood pressure.[2] Dex due to its distinct properties can be used as an anesthetic adjuvant in the form of intravenous infusion.[3] We studied the use of Dex in laparoscopic surgeries and evaluated its effects on hemodynamics, analgesic requirement and post op recovery.

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MATERIALS AND METHODS:

After approval of the Institutional Ethics Committee, sixty patients of age group 18-50 years belonging to American Society of Anesthesiologists (ASA) grade I and II; aged between18 to 50 years; of either gender; scheduled for laparoscopic surgeries like laparoscopic cholecystectomy, laparoscopic fundoplication, total laparoscopic hysterectomy, laparoscopic appendisectomy and laparoscopic adhesiolysis, under general anesthesia were enrolled for the study. Each group consist of 30 patients. Control Group NS (N=30) and Dex Group D (N=30). Patients with ASA grade III/IV and contraindication to the use of Dex e.g. liver, renal or cardiac disorder were excluded from study. After pre-anesthetic checkup, written, valid and informed consent was taken from patients posted for laparoscopic surgery under general anesthesia. Patients were pre-medicated with tablet alprazolam 0.5 mg the night before surgery. After taking patient in OT, two intravenous (IV) lines were secured, one for routine fluids and the other exclusively for Dex. Study medication was prepared in two identical 100 ml of 0.9% saline bottles, Dex

infusion in the concentration of 1mcg/ml.(100mcg /100ml saline) was prepared by an anesthesiologist who was blinded to the computer generated randomization schedule. The anesthetist blinded to the drug continued with the anesthesia process and recorded the study parameters. Baseline monitors like electrocardiogram (ECG), pulse oximetry, noninvasive blood pressure (NIBP) were attached. Baseline values were recorded. Patients in control group received NS infusion at the rate of 1ml/kg and continued for 20 min. After 20 min. infusion rate was changed to a maintenance infusion of 0.2 ml/kg/hr. While study group D received loading dose of Dex infusion at the rate of 1mcg/kg(1ml/kg) and continued for 20 min. After 20 minutes, the rate of Dex infusion was changed to a maintenance infusion of 0.2 mcg/kg/hr (0.2ml/kg/hr).

Patients were premeditated with glycopyrrolate 4mcg/kg, midazolam 0.03 mg/kg and ondansetron 8mg intravenously (IV). All the patients received fentanyl in dose of 2 mcg/kg IV. Anesthesia was induced with propofol 2 mg/kg IV. Succinylcholine 1.5 mg/kg was administered IV to facilitate intubation. Vasopressers response to laryngoscopy and intubation was documented by noting heart rate and blood pressure. All patients were intubated with appropriate sized cuffed endotracheal tube passed orally, and the placement was confirmed with auscultation and end-tidal carbon dioxide (EtCO2) reading. Anesthesia was maintained with nitrous oxide and oxygen mixture (60:40), and isoflurane. Vecuronium used as non depolarizing muscle relaxant. Intraoperative anesthetic requirement was gauged by hemodynamic HR and BP. Response to pneumoperitoneum was documented and requirement of additional anesthetic/analgesic noted. Whenever required, anesthesia was deepened by increasing the concentration of inhalational anesthetic agent. Any additional requirement of metoprolol or nitroglycerine to control BP was noted. Dex infusion was continued until extubation. Hemodynamic response to extubation was documented.

Intraoperative monitoring was documented during the pre-induction, after the loading dose of Dex, at the induction of anesthesia, during laryngoscopy and intubation, and at pneumoperitoneum and then every 15 min till the end of surgery and continued during extubation and post operatively. At the end of surgery, diclofenac sodium 75 mg was added to the IV fluid for postoperative analgesia. Any side effects like hypotension, bradycardia, respiratory depression, postoperative nausea and vomiting were noted. Patients were monitored in the recovery room, and then shifted to the ward.

Our study was prospective double blind case control study. Results are expressed as mean (Standard Deviation, SD) or median (range) unless otherwise stated. Statistics were performed using Chi Square test and Analysis of Variance (ANOVA) to compare the characteristics, and repeated measures of ANOVA were used to assess the changes in the HR and BP. p value < 0.05 was considered significant.

RESULTS:

A total of sixty patients were enrolled in our study. Table 1 depicts the demographic data. Mean HR on starting was 88±9.6 (19) which fell to lowest mean of 64.2 ± 9.6 (11) in study group D ($p = 0.0001$). HR was however sustained for the entire duration of infusion. Patients had sinus bradycardia (HR < 60) at the start; but none required any therapy for treatment of this bradycardia. Mean systolic blood pressure (SBP) to start with was 126±10.6, and fell to 96.6±10.2 with loading dose of Dex ($p = 0.004$). After that minimal change was observed for entire duration of infusion. Similar observations were made at the time of creation of the pneumoperitoneum. The rise in HR after intubation and after pneumoperitoneum was significant. Similar changes were observed in mean systolic blood pressure during intubation and pneumoperitoneum in NS group. Mean diastolic blood pressure (DBP) fell from 78±6.4 to 72±8.4 in Dex group which was not statistically significant. There was good control over the vasopressor response during laryngoscopy. None of the 30 patients in Dex group needed either metoprolol or nitroglycerine to counter the hypertension effect of pneumoperitoneum. While 80 % (24) patients needed propofol or metoprolol in NS group, other 20 % (6) needed both. The results were analyzed using IBM SPSS v 20.

The mean dose of propofol required for induction was 60.5mg. Intraoperative, whenever propofol was required, it was given in 10 mg top ups. We also studied the requirement of isoflurane which was adjusted to maintain stable BP. It was

Table 1: Patient's characteristics and duration of surgery (Mean ± SD)

	Group D(n=30)	Group NS(n=30)
Age (Years)	41.4 ±8.12	43.7±8.56
Sex (M:F)	13:17	11:19
Weight (kg)	59.24 ± 10.16	57.88 ± 10.4
Duration of surgery (min)	86.32 ± 11.26	80.15 ± 10.42

Table 2: Changes in Mean Arterial Pressure (Mean ± SD)

	Group D	Group NS	Statistical Significance
Preoperative	126.4 ±10.6	124±10.8	p>0.05; NS
After infusion	96.6±10.2	118.2 ±10.3	p<0.01; HS
1 min after induction	82±6.8	98±12.4	p<0.01; HS
1 min after intubation	90.2±10.2	118.6 ±14.12	p<0.05; S
After Pneumoperitoneum	94±10.6	128±18.11	p<0.01; HS
15 min	90±12.8	132±13.6	p<0.05; S
30 min	86±12.4	128±18.4	p<0.05: S
45 min	87±13.4	126±15.4	p<0.05; S
60 min	90±14.5	126±10.4	p<0.05; S
End of Pneumoperitoneum	84.2±12.8	120±12.6	p<0.01; HS
Postoperative period	88.6±10.12	111.14 ±18.26	p<0.05; S

Table 3: Changes in Heart Rate (Mean ± SD)

	Group D	Group NS	Statistical Significance
Preoperative	88± 9.6	86.2 ± 9.2	p>0.05; NS
After infusion	72 ± 9.2	82 ± 10.6	p<0.05; S
1 min after induction	64.2 ± 9.6	79.4 ± 11.5	p<0.05; S
1 min after intubation	70.2 ± 10.4	97.2 ± 12.7	p<0.01; HS
After Pneumoperitoneum	74.8±9.3	96±13.8	p<0.01; HS
15 min	74±10.3	92±13.4	p<0.05; S
30 min	76±10.2	96±14.3	p<0.05; S
45 min	74±9.1	94±13.2	p<0.05; S
60 min	72±11.2	96±12.8	p<0.05; S
End of Pneumoperitoneum	72±10.4	90±10.2	p<0.05; S
Postoperative period	73.2±9.6	96.4±15.4	p<0.01; HS

S–Significant; NS –Not Significant; HS –Highly Significant

observed that the end-tidal concentration of isoflurane required was between 0.8 to 1.2 throughout the surgery, with peak requirement at the beginning immediately after intubation, and then again during creation of pneumoperitoneum. Concentration of is isoflurane as was observed to be almost 30% less with Dex.

Total fentanyl requirement after pneumoperitoneum in saline group was extubation response was studied which appeared to be smooth in

Table 4: Recovery time (min), Mean ± SD

	Group D	Group S	Statistical Significance
Extubation time (min)	4.28 ± 1.08	9.18 ± 2.24	p<0.05; S
Response to verbal command (min)	6.76 ± 1.41	10.89 ± 2.48	p<0.05; S
Time for orientation (min)	6.93 ± 1.60	12.42 ± 1.21	p<0.05; S

Dex group compared to saline group. Patients showed immediate eye opening and were responsive to verbal commands indicating no residual effects of Dex. There was no difference in vecuronium requirement in both the groups. All patients were hemodynamically stable and comfortable of Dex group in the recovery room. None of patients had postoperative nausea and vomiting (PONV), hypotension, bradycardia or episodes of respiratory depression and were shifted to the ward after two hours.

DISCUSSION:

Laparoscopic surgery offers intraoperative stress during pneumoperitoneum by increasing the systemic vascular resistance and blood pressure at the same time producing nociception.[2] Dex, an imidazole compound, displays specific and selective α_2 adrenergic receptor agonism.[4,5]The unique properties of Dex render it suitable for analgesia during the perioperative period.[6]The major sedative and antinociceptive effects of Dex are attributable to its stimulation of α_2 A subtype located in locus coeruleus[7].It is the specificity of dex for α_2 receptor that makes it a more effective sedative and analgesic agent than clonidine. Dex is eight times more specific for α_2 receptors than clonidine (α_2: α_1 ratio for dex is 1620:1 and that for clonidine is 220:1).[17]

Dex potentiates anesthetic effects of all intraoperative anesthetics, regardless of the method of administration. The profound reduction in anesthetic requirement was shown to be mediated through central α_2 adrenergic receptors. Possible anesthetic effects also have been suggested in humans. IV and IM administration has shown to reduce requirement of thiopentone by 17% in a group that receiving low dose Dex, and up to 30% in a group receiving high dose Dex. [8]We observed that Dex significantly reduces induction dose of propofol. Dex also decreases the requirement of inhalational agents. Routine end tidal concentration required for maintenance of anesthesia is 0.8 to1.2%.[3]First report of reduced requirement of isoflurane with Dex in humans was published in 1991[9],which showed a 25% reduction of maintenance and concentration of isoflurane in patients who received Dex. A 35-50% reduction of isoflurane requirement in patients treated with either low or high doses of isoflurane without premedication has been reported. [10]Similar observations regarding isoflurane requirement were made in our study.

Dex has been shown to attenuate the sympathoadrenal stimulation during intubation effectively.[11] We observed that Dex effectively attenuates the vasopressor response of laryngoscopy, and intubation and the sympathoadrenal response occurring with pneumoperitoneum. Analgesic properties have been demonstrated in studies that used Dex as a sole analgesic after minor surgeries. [12]Opioid requirements in the intra and post-operative period are reduced by Dex. The α_2 mechanism of action is involved in modulation of nociception at the level of spinal noradrenergic systems.[13] There is a clear evidence that α_2 receptors located in dorsal horn neurons of spinal cord might release endogenous opiate compounds. [14] We observed that fentanyl in the dose of 1.5 mcg/kg was sufficient to provide analgesia, at least till the time of pneumoperitoneum. However, 20% of patients required fentanyl top up during pneumoperitoneum. Dex has been shown to provide good hemodynamic stability.

Dex has shown less respiratory depression than any other sedatives.[15] infusion can be continued safely till extubation.[16] In our study, none of the 30 patients had episodes of respiratory depression in the post-operative period. Dex use permits lower doses of anesthetics to be used and decreases the opioid requirement, thus resulting in a more rapid recovery from anesthesia.

CONCLUSION:

Dexmedetomidine, a highly selective alpha 2 agonist, is an effective anesthetic adjuvant that can be safely used in laparoscopic surgery. We observed that

Dex is a good anesthetic adjuvant that decreases the requirement of anesthetics and opioid, attenuates sympathoadrenal response, maintains the stable hemodynamic, and provides an excellent recovery profile.

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Case Series

Endodontic Management of Mandibular Second Molars with 'C' Shaped Root Canal Configuration – Reports of Three Cases

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ABSTRACT

Recognition of unusual variations in the canal configuration is critical because it has been established that the root with a single tapering canal and an apical foramen is an exception rather than the rule. The C- shaped configuration, which is an important anatomic variation, is characterized by a C-shaped groove that connects one or more root canals. This groove can occur anywhere along the root canal system, making it difficult to diagnose and treat. Furthermore, C-shaped canals are challenging if not possible to predict radio graphically.

The aim of presented three case reports is to describe different types of C-shaped canals in mandibular second molars and their endodontic management. In the first case report of tooth #47, preoperative radiograph showed fusion of roots, and the root canal outline were not clear. Therefore CBCT was advised to the patient confirming the C shaped root canal configuration, which persisted along the entire length and width of the C-shaped root canal and exits at single apical foramen. In the second case report of tooth #47, the anatomy of the floor of the pulp chamber suggested an incomplete "C" with the fusion of the mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal giving the appearance of semicolon (;) The third case report of tooth #47 radiographically, the tooth had unusual root morphology with a single conical root. Clinically, the pulp chamber floor had a C-shaped continuous trough.

KEY WORDS: cone beam computed tomography, c-shaped canals, c-shaped root canal configuration, mandibular second molar,

INTRODUCTION:

A thorough knowledge of the anatomy of teeth involved in root-canal treatment is essential for successful debridement and obturation of the root-canal system. Recognition of unusual canal configurations and variations are paramount because it has been established that the root with a single tapering canal and an apical foramen is an exception rather than the rule.[1]Root canal configuration of the mandibular second molars shows great deal of variations. The "C"-shaped canals were first documented by Cooke & Cox[2] in three case reports. The frequency of C- shaped canals ranges from 2.7 to 8%.[2, 3]

The main anatomical feature of C- shaped canal is the presence of a thin fin connecting the root canals.[4] Once recognized, the C-shaped canal provides a challenge with respect to debridement and obturation, especially because it is unclear whether the C-shaped orifice found on the floor of the pulp chamber actually continues to the apical third of the root. Two or three canals may be found in the 'C' shaped groove, or the C-shape may be continuous throughout the length of the root.

Although C-shaped root canals are most frequently seen in the mandibular second molars, but they can occur in any mandibular molars and premolars. They have been reported in maxillary molars as well.[5]

Mandibular molars with C-shaped root canal system display fusion of the roots from the buccal or lingual aspect, with a radicular ridge opposite to a convex surface, and a root morphology which may be conical, square or in C-shape[6, 7, 8]. This fusion remains irregular, and the two roots stay connected by an interradicular ribbon. The floor of the pulp chamber is deep and has an unusual anatomical appearance.[4,9]

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The pulp chamber has a single ribbon shaped orifice with a 180 degree arc from distal to mesial canals.[10]

The concavity of the C may be oriented buccally or lingually.[11] In other cases the orifice may take the form of an incomplete 'C', with the union of the distal and mesiobuccal canals, and the presence of an isolated mesiolingual canal, giving the canals an appearance of a semicolon.[9, 12] It may also present as a C-shaped canal with the union of distal and mesiolingual canals, and a separate mesiobuccal canal. It is important to emphasize that this C-shaped variation of the anatomy can occur throughout the length of the root canal, which complicates the stages of biomechanical preparation and obturation of teeth displaying this type of internal anatomy.

Preoperative radiographs of the mandibular second molars with C-shaped canals demonstrate close fused roots or images of two distinct roots. This occurs when the communication is thin and thus, not visible on the X-rays. This makes the clinical recognition of the C-shaped canal unlikely until access to the pulp chamber has been achieved.[4] Radiographs taken whilst negotiating the root-canal system may suggest such anatomy as they can reveal two characteristics: instruments tending to converge at the apex[13] or instruments appearing both clinically and radiographically to be centered and appearing to be exiting the furcation. This can cause confusion and initiate a search for a perforation.[4,8]

The aim of presented three case reports is to describe C-shaped canals in mandibular second molars with type-1 and type-2 configurations and their endodontic management.

CASE REPORT 1:

A 22 year old male patient reported to Department of Conservative Dentistry and Endodontics of Sri Aurobindo College of Dentistry and P.G. Institute, Indore with a chief complaint of spontaneous pain in lower right back tooth region of jaw. The patient's medical history was not contributory. One week before patient visited a dentist with same chief complaint and underwent some treatment. Intra oral examination revealed presence of an intermediate restorative material sealing the occlusal cavity of right mandibular second molar (#47). The tooth was severely tender on vertical percussion. Diagnosis of irreversible pulpitis with acute apical periodontitis was made and endodontic treatment of tooth was planned.

Radiographic examination revealed a fused single conical root with unusual and complex anatomy. There was widening of periodontal ligament space (Figure 1). After administration of anesthesia, rubber dam was applied and under surgical operating microscope the access cavity was refined. The floor of pulp chamber revealed a C shaped canal. To confirm the complete anatomy CBCT was adviced. CBCT was suggestive of true Type 1 of Melton's classification (Figure 2).

Figure1: Preoperative radiograph showing fused single conical root with unusual and complex anatomy.

The access cavity was flushed with 5.25% of sodium hypochlorite and 17% EDTA solution. The pulp chamber floor was examined carefully. Instead of having three separate orifices, it had a continuous C-shaped trough that started from the location of mesiobuccal canal orifice to the location of distobuccal canal orifice, with its convexity facing towards the buccal surface. Coronal flaring was done with the help of Sx Protaper (Dentsply Maillefer) and the canals were irrigated copiously again with 5.25% of sodium hypochlorite and 17% EDTA solution. Working length was determined with the apex locator Root ZX (J Morita) which was confirmed radiographically (Figure 3).

The irrigating solution in the root canals was activated with ultrasonic device (P5 booster Satelec with attached endosonic files) to debride the canal more effectively. The resulted 'acoustic streaming' allowed greater volumes of irrigants entering and penetrating the canal system, thus promoted thorough cleaning of the narrow areas of the canal. Cleaning and shaping of the root canal was initiated with rotary Protaper (Dentsply Maillefer) in the wider portion of the root canals, followed by circumferential filing using the hand instruments, K and H files (Mani INC) to achieve uniform canal preparation. During the preparation inspite of having sign and symptoms effective anesthesia patient complained of pain for which intra pulpal anesthesia was administered. The

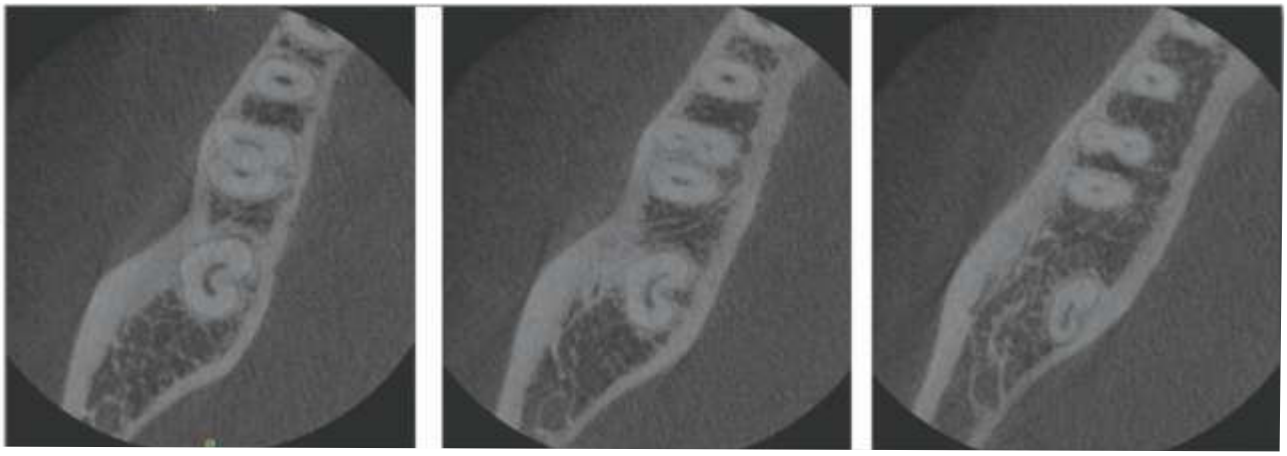

Figure 2: The CBCT scan view showing true type 1 Melton's classification at coronal, middle and apical third of the canal.

Figure 3: Radiographic determination of working length.

Figure 4: Radiograph showing the snuggly fitted master Gutta percha.

pulp space was again flushed with 5.25% of sodium hypochlorite and 17% EDTA solution. All the canals were dried using the sterile absorbent paper points. The canals were coated with AH-26 sealer (Dentsply Maillefer) and the tooth was obturated with thermoplasticised injectable gutta-percha technique along with a master cone to prevent extrusion of gutta percha beyond the apex (obtura II Obtura corporations) (Figure 4,5).

Tooth was temporized with IRM cavit G (3M ESPE). Post obturation radiograph was taken which revealed well obturated root canal space with the C shaped communication extended to the apex of the tooth (Figure 6). The patient was recalled after one week for permanent restoration.

After one week the tooth was asymptomatic and it was restored with composite resin. The patient was kept on periodic follow up for six month.

CASE REPORT 2:

A 24 years old male reported to the department with the chief complaint of pain and food lodgement in mandibular right back tooth region since last 15 days. The pain was dull in nature with mild intensity. On clinical examination the tooth #47 was grossly carious with an exposed pulp. Intra oral periapical radiograph of the tooth displayed fusion of roots and a conical root morphology with a periapical radiolucency associated with the root apex of tooth #47 (Figure 7).

Figure 5: Radiograph showing the completely obturated #47

The outlines for the individual root canals were not clear. The tooth was non tender on percussion and had no pain on palpation. On electrical (Digite ST Parkell) and thermal pulp testing, the tooth was non responsive to stimuli, suggesting loss of vitality. A diagnosis of chronic irreversible pulpitis with chronic apical periodontitis was made and an endodontic treatment of the tooth #47 was planned.

All the principles of endodontic treatment were followed. After preparation of access cavity pulp chamber floor was carefully examined. The anatomy of the floor of the pulp chamber suggested an incomplete 'C' with the fusion of mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal giving the appearance of semicolon(;). This case therefore, demonstrates the morphological pattern of Melton's type- 2 C shaped root canals (Figure 8).

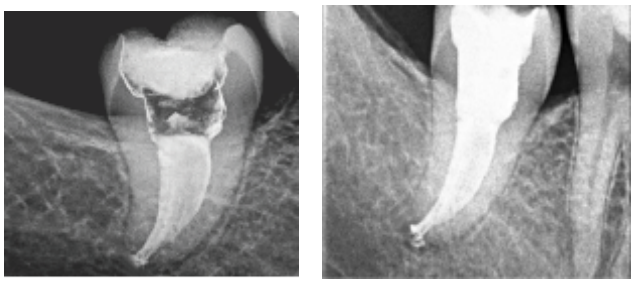

Figure 6: Radiograph showing post endodontic restoration with #47.

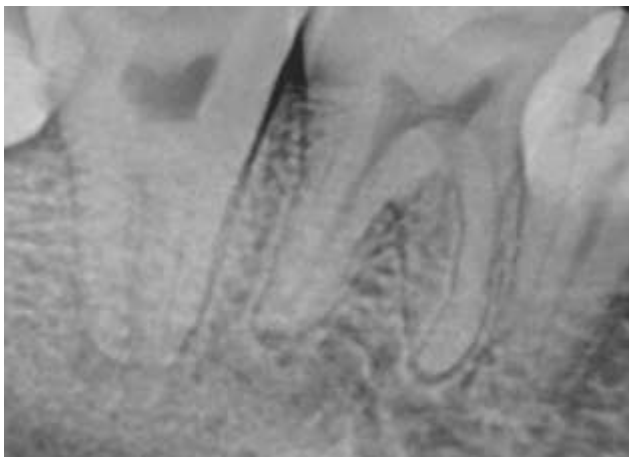

Figure 7: Intra oral periapical preoperative radiograph #47 showing fusion of roots and conical root morphology.

The instruments in the mesiolingual and distal root canals were confluent at the apex and exit at single apical foramen (Figure 9). However, the orifice of mesiobuccal root canal was separate. Since the anatomy of the floor of the pulp chamber suggested an incomplete 'C' with the fusion of mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal. Therefore, a combination of the thermoplasticized and cold lateral condensation techniques were used to achieve the effective sealing of the root canal space.

Figure 8: A mandibular right second molar with an incomplete "C". Note the fusion of mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal giving the appearance of semicolon (;).

Figure 9. The instruments in the mesiolingual and distal root canals were confluent at the apex and exits at single apical foramen. Note the separated orifice of mesiobuccal root canal.

All the root canals were coated with AH-26 sealer. The separated Mesiobuccal root canal was obturated with the conventional cold lateral condensation technique since, the mesiolingual and the distal root canals were fused; therefore, thermoplasticised injectable gutta-percha technique was used. Post obturation radiograph was taken which revealed well obturated root canals with the C shaped communication between the mesiolingual and distal root canals extended to the level apical one third (Figure 10).

Figure 10: Immediate post obturation radiograph.

Figure 11:. Preoperative radiograph of tooth #47 revealed a single wide conical root

CASE REPORT 3:

A 45 years old female reported to the Department with the chief complaint of pain in the right mandibular back tooth region since past one month. The pain was throbbing in nature and severe in intensity. The pain aggravated during lying down position. On clinical examination, the tooth #47 had a deep carious lesion involving the pulp. Intra oral periapical radiograph revealed unusual root morphology with a single conical root. The periodontal ligament space associated with the root apex of tooth #47 was thickened (Figure 11).

The tooth was tender on vertical percussion and had no pain on palpation. On thermal heat pulp testing, the tooth exhibited an immediate, intense painful response. On electrical pulp testing (Digite ST Parkell) the tooth was non responsive suggesting loss of vitality. A diagnosis of chronic irreversible pulpitis with apical periodontitis was made and an endodontic treatment of the tooth #47 was therefore planned. The endodontic treatment procedure instituted is same as of case report 1 (Figure 12, 13 and14).

Figure 12: A mandibular right second molar with complete C- shaped canal. Note the floor of the pulp chamber had a C-shaped continuous trough .

Figure 13: Working length radiograph showing all the endodontic instruments confluent at the apex and exiting at single apical foramen.

DISCUSSION:

The 'C' shaped root canal often poses a challenge to the clinician owing to its complex root canal anatomy. Because of their atypical anatomy, C-shaped canals demand more concern at all stages of the procedure. This represents a true challenge to the operator, in the diagnosis, cleaning and shaping, and three dimensional sealing.[2, 6, 13, 14, 15, 16]

Variations in the number as well as the position of the canals can occur in different thirds of

Figure 14: Immediate post obturation radiograph showing well obturated c- shaped canal. Note the C shaped communication extended to the apex of the tooth.

the root.[8] A tooth with a C-shaped canal orifice may have a canal system that presents a continuous C-shape from the coronal to the apical third. In this instance, endodontic instruments of small size used to explore the canal may pass freely through the foramen. This canal type is also known as a 'true' C shape. Often, a true C-shaped canal will be recognized because it has a C-shaped orifice. However, a true C-shaped canal can also occur while presenting separate orifices at the pulpal floor level. A C-shaped canal may commonly bifurcate at any level in the root from coronal to apical[12], and anastomoses between canals can also occur.[8,16]

Melton, et al[8] proposed the following classification based on the different configurations of the orifices in C-shaped canal systems.

- **Type I**- A continuous C-shaped canal, with no separation of the canals.
- **Type II**- The canal orifices resemble a semicolon (;), where a C-shaped canal is present buccally or lingually, separated from another distinct canal by a dentine wall.
- **Type III**- Two or more separate canals are present, as in a typical lower molar, with three canal orifices.

The presented case report 1 and 3 can be assigned to type 1 of Melton's classification as it has got a continuous 'C' shaped trough at the floor of the pulp chamber. The trough was extensive and persisted along the entire length and width of the C-shaped root canal and exits at single apical foramen. These cases demonstrate the morphological pattern of the true type 1 C-shaped root canal.

The Second case report can be assigned to type 2 of Melton's classification. The anatomy of the floor of the pulp chamber suggested an incomplete C with the fusion of mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal giving the appearance of semicolon (;). This case demonstrates the morphological pattern of type- 2 C shaped root canals. Melton et al [8]. also commented on the large amount of debris in instrumented canal space for which many authors agree on using ultrasonic files to facilitate their removal. Similarly, in the presented case reports 5.25% of sodium hypochlorite and 17% EDTA solution was used as an irrigant and activated by ultrasonics. The resulted "acoustic streaming" allowed greater volumes of irrigants entering and penetrating the canal system, thus promoted more thorough cleaning of the narrow areas of the canal.17% EDTA is used in combination with 5.25% of sodium hypochlorite to remove the smear layer.

Cooke and Cox[2] described three cases of endodontic treatments in lower molars with C-shaped canals which highlighted the difficulty of identifying C-shaped root canals based only on the pre-operative radiographic appearance, since in all the three reported cases the radiographs gave the impression of two roots, and the anatomy of the floor of the pulp chamber suggested separate canals. The finding of presented case reports was in contrast to Cooke and Cox[2]. In the presented case reports, the C shaped root canal configuration could be predicted by careful examination of a good quality preoperative radiograph, as the tooth had unusual root morphology with a single conical root.

Barnett[9] commented that the radiograph can indicate the presence of distinct root canals, even when the tooth has a C-shaped canal system. It is very difficult to identify this atypical configuration at the initial radiographic examination, and only after the access cavity has been made will the diagnosis become clear[5,7,9,11].In the presented case reports radiographically, all three teeth had unusual root morphology with a single conical root which is suggestive of abnormal root canal configuration. Diagnosis of 'C' shaped root canal configuration became clear only after the access cavity has been made and examining the floor of the pulp chamber.

Rice & Gilbert[13] considered the interpretation of pre-operative radiographs fundamental to the success of the endodontic treatment of C-shaped canals, since it can demonstrate the presence of atypical root configurations. The importance of good quality preliminary radiographs taken from at least two angulations cannot be overstated. Jerome[15] believed that limited information about whether roots

are fused or merely close can be obtained from evaluation of pre-operative radiographs, affirming that the radiographic appearance of two roots does not eliminate the possibility of the presence of a C-shaped canal system, in such cases the dentine isthmus that joins the roots may so be fine that it does not appear radiographically.[14,15] In the presented case reports it is suggested that the importance of good quality preoperative radiograph as the abnormal configuration could be predicted by carefully examining the preoperative radiographs.

When the radiographs are taken for the purpose of working length measurement, the endodontic instruments can appear to be misplaced in the furcation, especially in Class 1 C-shaped canals. This can lead the operator to mistakenly suspect a perforation. [8, 9, 14, 15] Another factor that can cause the operator to suspect perforation is the occurrence of intense hemorrhage during access to the pulp chamber. In addition, the patient may complain of constant sensitivity throughout the appointment, even after intrapulpal anesthesia, giving rise to difficulty with procedures such as pulpectomy and biomechanical preparation of the canals.[2, 7, 13,15] Similarly, in the presented first case report, the patient constantly complained of pain and sensitivity during cleaning and shaping of the root canals.

In all the three types of C-shaped canals, the 'main' canals can be cleaned and shaped normally; however, the instrumentation of the isthmus that connects these canals requires care, because although it may be extensive, it may also be very narrow.[9,15] These areas are prepared using small sized endodontic instruments and copious amounts of irrigants. Gates Glidden drills cannot be used in the isthmus due to the great risk of creating a perforation to the periodontal ligament.[15] In this situation the irrigation solutions assume a very important role. 5.25% of sodium hypochlorite, with its capacity to dissolve organic material, is the solution of choice.[11,15] Manual instrumentation can be augmented with ultrasonic devices to debride the canal more effectively[9,13], since they can result in greater volumes of irrigants entering and penetrating the canal system, thus promoting more thorough cleaning of the narrow areas of the canal. Similarly, in the presented case report 5.2% of sodium hypochlorite and 17% EDTA was used as an irrigant. The irrigation solution was activated by ultrasonics for the effective debridement of the root canals.

For obturation of such an atypical configuration, one should select a technique that facilitates the effective sealing of complex root canal systems. Because of the C-shape, complete obturation of the canal is difficult. The technique of cold lateral condensation, which is clinically satisfactory in the majority of cases, is not sufficient to ensure complete obturation of the complex root canal, as cold gutta percha cannot fill all the unevenness. In such situation the thermoplasticised gutta percha is an appropriate technique; because, thermoplasticisation allows better dispersal of the endodontic sealer and gutta percha, and so they are more likely to fill the irregularities of the C-shaped canal system. Similarly, in the presented first case report, the pulp chamber floor had a C-shaped continuous trough. The trough was extensive and persisted along the entire length and width of the C-shaped root canal. Hence, thermoplasticised technique of obturation was used.

Walid[17] suggested obturating the main root canal using lateral condensation and the central part of the canal with thermoplasticized technique. Similarly, in the second case report, since the anatomy of the floor of the pulp chamber suggested an incomplete 'C' with the fusion of mesiolingual and distal root canals and a separate orifice for mesiobuccal root canal, a combination of the thermoplasticized and the cold lateral condensation techniques were used to achieve the effective sealing of the root canal space. Mesiobuccal root canal was obturated with the conventional cold lateral condensation technique. Since, the mesiolingual and the distal root canals were fused; therefore, thermoplasticised technique is used to obturate the fused canals.

The root configuration of molars having this canal shape may be represented by fusion of either the facial or lingual aspects of the mesial and distal roots. Radiographic detection of root fusion is difficult since the criteria for its recognition are ambiguous. Thus, recognition of C-shaped canals is improbable until access to the pulp chamber has been achieved. The criteria used for the radiographic recognition of C-shaped mandibular second molars, although based on their morphology, may be misleading as the anatomic complexities of all teeth is well established in the literature and roots can have great variations in size, shape, and orientation. Presence of instruments or filling materials in the furcation area may also be seen in cases of furcation perforation. However, this finding, in combination with the poorly distinguished floor of the pulp chamber, can lead to radiographic recognition of a C-shaped configuration. Clinical recognition of C-shaped canals was based on definite and observable criteria, i.e. the anatomy of the floor of the pulp chamber and the persistence of hemorrhage or

pain when separate canal orifices were found.

Cooke & Cox[2] asserted that it was impossible to diagnose C-shaped canals on preoperative radiographs.[18]

The magnification provided by the Dental Operating Microscope is a great aid in the interpretation of the anatomy of the floor of the pulp chamber, and thus facilitating effective access to the canal system.

Various clinical studies have highlighted the role of CBCT as an objective analytical tool to ascertain complex root morphology. Conventional 2D radiographs might not provide adequate diagnostic information for clinician to appreciate complicated morphology of root canal system, these problems can be overcome by using SCT and CBCT, which can provide 3D images of individual teeth and surrounding tissues. But it is equally important that radiation doses should be low. Matherne et al. in their study have reported the superiority of CBCT over other diagnostic methods and suggested the simultaneous use of the operating microscope and CBCT.[19] Although μCT has been compared to CBCT and reported to be more precise with up to 2 μm resolutions[20,21], however, the limitations include amount of time required and its usage restricted to only ex vivo studies[22, 23]. Accuracy of CT imaging is well-documented. Major advantages of CBCT over conventional CT scans include X-ray beam limitation[24], rapid scan time[25] and effective dose reduction[26]. The approach offers a non-invasive reproducible technique for 3D assessment of root canal systems and aids the clinician to visualize the internal anatomy precisely[27]. Furthermore, use of this technique has been firmly advocated in the recent past for diagnosis of root canal aberrations.[28]

CONCLUSION:

C-shaped canal in mandibular molars is one of the most difficult situation with which the dentist is confronted during endodontic treatment of teeth. Magnification and illumination can help to identify these hard to detect C shaped configurations. Majority of the partially missed canals were detected at apical third level which suggests that clinically it is more difficult to clean, shape and obdurate this area in C-shaped canal system. Clinically, it is extremely important to perform root canal instrumentation cautiously during treatment as a lot of variation and anatomical diversity pertaining to the shape and thickness exist at each level in teeth with C-shaped canal system. One should be aware of these danger areas so as to avoid the perforation during treatment of such canal system.

These case reports suggested that the existence of C-shaped canal system could be predicted by studying carefully the pre operative radiographic image of mandibular second molar. However, clinical examination of the floor of the pulp chamber, and pre-treatment radiographs are equally important when attempting to diagnose a C-shaped canal configuration.

It is evident that, for endodontic treatment of teeth with C-shaped canal systems to be successful, there must be modification of procedures at all stages of the treatment and new resources must be used.

The magnification provided by the dental operating microscope would be of great aid in the interpretation of the anatomy of the floor of the pulp chamber, and thus facilitating effective access to the canal system.

As well known from literature that periapical radiographs are misleading therefore; we strongly recommend use of CBCT as diagnostic tool in detecting aberrant canal configuration. Computer Aided Tomography (CAT scan) would be an additional resource for such an abnormal configuration of root canals which enables three-dimensional reconstruction of root canal systems in high resolution.

Use of 5.25% of sodium hypochlorite with 17% EDTA solution for irrigation activated by ultrasonic instrumentation aid greatly in debridement and devices for thermoplasticisation of Gutta Percha for effective sealing of the root canal space is recommended.

Clinically, when a C-shaped canal system is observed, one cannot assume that such a shape continues throughout its length. The prognosis of such complex canal anatomies can be improved by simultaneous use of sophisticated techniques such as surgical operating microscope and CBCT.

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Additional Nerve Supply of Gluteus Maximus by Common Peroneal Nerve

Case Report

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ABSTRACT

During routine dissection, variation of sciatic nerve was discovered bilaterally. Sciatic nerve emerged from the pelvis through greater sciatic foramen. On both sides, it divided into common peroneal nerve and tibial nerve. Common peroneal nerve pierced the piriformis muscle with resultant splitting of the muscle into two parts. Tibial nerve emerged at the lower border of muscle, thus two divisions of sciatic nerve were separated by the inferior belly of the piriformis muscle. On the left side common peroneal nerve from its medial edge gave branches which innervated gluteus maximus muscle from its deeper aspect. On the right side both common peroneal nerve and tibial nerve gave branches to gluteus maximus muscle. In addition, bilaterally gluteus maximus was innervated by inferior gluteal nerve.

KEY WORDS: CPN (common peroneal nerve), gluteus maximus muscle, innervation, SN (sciatic nerve), TN (tibial nerve)

INTRODUCTION:

Sciatic nerve enters the gluteal region from the pelvic cavity by passing inferior to the piriformis muscle. The nerve then divides into tibial (TN) and the common peroneal nerves (CPN) in the lower part of the back of the thigh. Gluteus maximus muscle is normally innervated by the inferior gluteal nerve which is the sole motor innervation of the muscle.

CASE REPORT:

During routine cadaveric dissection of gluteal region variation of SN was discovered bilaterally in a 72-year-old embalmed male cadaver. Gluteus muscle was cut vertically in its middle and then the muscle was reflected medially and laterally.

LEFT SIDE (FIGURE 1):

Sciatic nerve emerged from the pelvis as a compact bundle through infra-piriformic compartment of the greater sciatic foramen. After running a short course of 0.5cm, it divided into thinner CPN and thicker TN. The CPN pierced the piriformis muscle from its deeper surface with resultant splitting of the muscle belly into two parts. Tibial nerve descended deep to the pirifomis muscle and emerged at its lower border; the two divisions of common peroneal were separated by the inferior belly of the piriformis muscle. Another feature observed was that the CPN from its medial edge gave a branch which further divided into three sub branches which innervated gluteus maximus muscle from its deeper aspect. This nerve supplied more than upper two third of the muscle. These branches were not accompanied by any vessels. Inferior gluteal nerve left the pelvic cavity in a typical manner accompanied by inferior gluteal vessels below the piriforms and supplied nearly less than lower one third of the gluteus maximus muscle. Inferior gluteal nerve was thinner than the branches of CPN supplying gluteus maximus.

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RIGHT SIDE (FIGURE 2):

Like the left side, immediately after exit from greater sciatic foramen, SN showed early division in the gluteal region. Common peroneal nerve pierced the piriformis muscle and divided the latter into two parts and the TN descended deep to pirformis. The

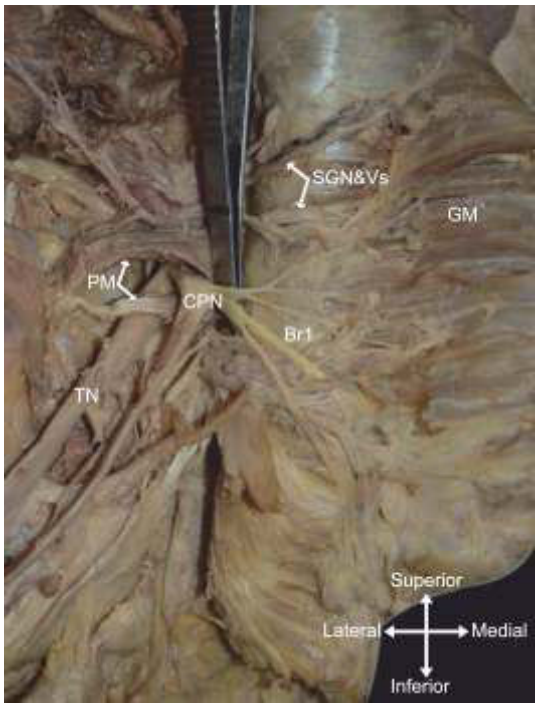

Figure 1: Left dissected gluteal region showing CPN emerging through the substance of the pririformis with resultant splitting of the muscle. TN descending deep to pririformis.CPN giving branches to gluteus maximus. Inferior gluteal nerve giving branches to lower part of gluteus maximus. Abbreviations used =CPN-common peroneal nerve; TN- tibial nerve; IGN-inferior gluteal nerve; GM-gluteus maximus; PM-pirifromis muscle; Br 1-branches; Vs – vessels; SGN – superior gluteal nerve.

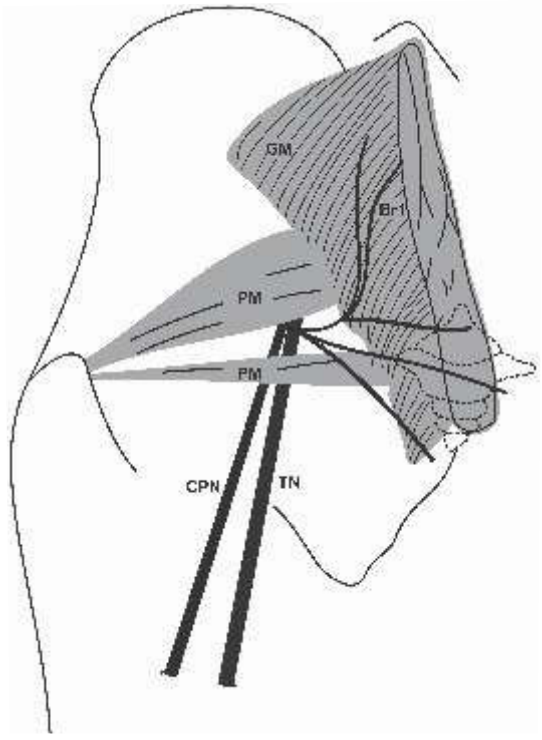

Figure1 A -Schematic sketch of Right dissected gluteal region.

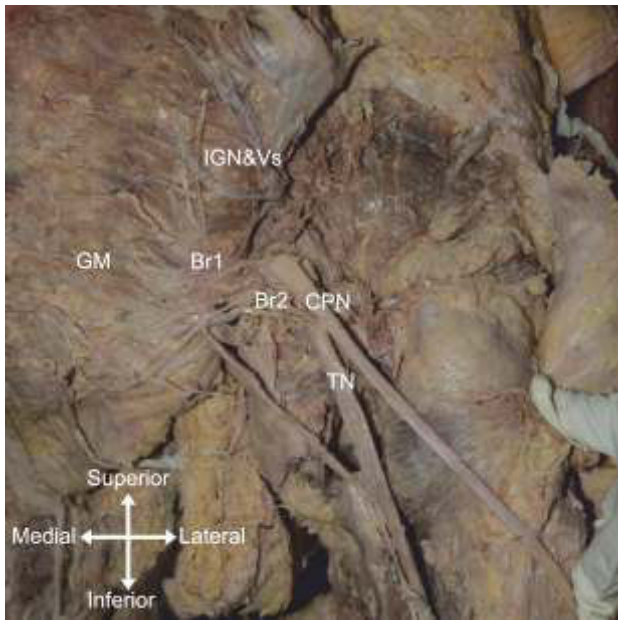

Figure 2: Right dissected gluteal region showing CPN emerging through the substance of the pririformis with resultant splitting of the muscle. TN descending deep to pririformis.CPN giving branches to gluteus maximus. TN giving two branches to gluteus maximus Inferior gluteal nerve giving branches to lower part of gluteus maximus. Abbreviations used same as figure 1a.

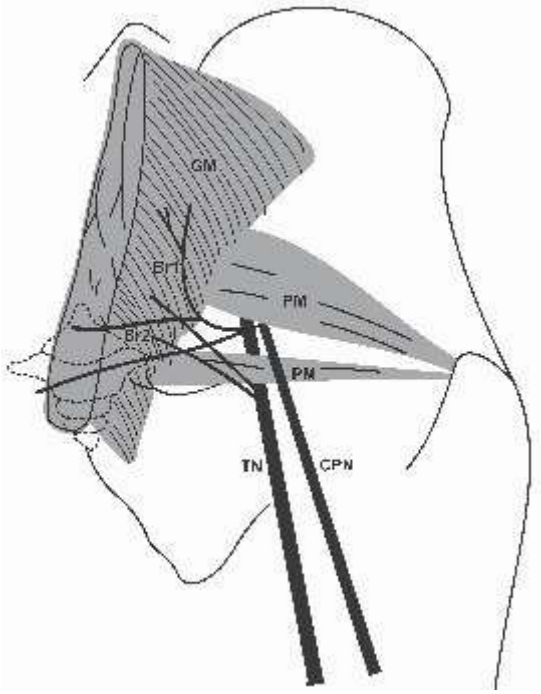

Figure 2A: Schematic sketch of Left dissected gluteal region.

CPN gave two branches which were supplying the maximus muscle. Tibial nerve also gave two branches which too innervated the gluteus maximus muscle. Inferior gluteal nerve was supplying the lower one fourth of the muscle.

gluteus maximus muscle. Tibial nerve also gave two branches which innervated the gluteus maximus muscle.

Inferior gluteal nerve was supplying lower one fourth of the muscle. No muscular branches of CPN and TN were accompanied by any vessel.

DISCUSSION:

Many variants of relationships of Sciatic nerve (SN) with the piriformis have been described in the literature. Incidence passage of CPN through the piriformis muscle and of exit of TN at the inferior margin of the muscle have been reported to be 12- 20 % . The unusual feature of present case is innervation of gluteus maximus muscle by CPN and TN. Couple of articles, published recently have mentioned such variation. Bhattacharya et areported a case of early division of the left SN in the pelvis and passage of CPN between two piriformis muscles but unlike our case two divisions of SN reunited into a single trunk in the gluteal region and abnormality of CPN emerged between two heads of piriformis to supply gluteus maximus.. Sumalatha et al found a case, with innervations of gluteus muscle from both TN and CPN parts of SN but unlike our case it was marked by the absence of inferior gluteal nerve. Unlike these two cases, we found the variations bilaterally. Common feature in all these cases of atypical innervations of gluteus maximums by CPN is the early division of Sciatic nerve and passage of Common peroneal nerve through the piriformis muscle.

Many authors[3-7] observed that the CPN palsy, although rare, is a serious complication of total hip arthroplasty which can cause permanent functional impairment and disability. Laceration, ischemia, compression, traction, denaturation due to heat, and a combination of these are the mechanisms responsible for neurological injury. In such cases of innervations of gluteus maximus by CPN, besides the typical features of CPN injury, weakness of gluteus maximus muscle an important antigravity muscle will further add to disability. Person will find difficulty in standing up from sitting posture. In children infra gluteal intramuscular drug injection is one of causes of SN injury.[8] Such cases may present with additional features of gluteus maxumus muscle weakness. In literature there is no mention of gluteus muscle weakness or paralysis following injury of CPN in the gluteal region. It seems innervation of this muscle by CPN is quite rare.

Another possible consequence of such anomaly is compression of SN or its part by piriformis muscle leading to pirifomis syndrome. Compression by piriformis muscle may arise due to its spasms resulting from overuse especially in persons involved in sports or physical exercise that require excessive use of gluteal muscles, injury or hip problems thus triggering pressure on the CPN with resultant leg pain or numbness. Identification of the additional bellies of piriformis is necessary for adequate decompression of sciatic nerve in such cases. Tenotomy of the piriformis muscle with such unrecognized cases of CPN passage through the piriformis muscle may result in CPN damage.[9,10] Posterior approach to hip joint sometimes piriformis muscle neeed to be divided.

In such cases knowledge of such variations would prevent inadvertent injury to the nerve.

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Case Report

Post-Obstructive Pulmonary Edema Following Accidental Strangulation: POPE – A Rare Medical Emergency

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ABSTRACT

Post obstructive pulmonary edema (POPE), a rare form of non-cardiogenic pulmonary edema, is a lesser known medical emergency which occurs due to acute upper airway obstruction (Type I) or following surgical relief of chronic airway obstruction (Type II). Though cases of POPE have been reported after various causes of upper airway obstruction but POPE developing after strangulation have not been reported widely. We report a 14 years old boy who developed POPE following accidental strangulation and complete recovery following prompt treatment with ventilator support and supportive care.

KEY WORDS: acute upper airway obstruction, NPPE, pulmonary edema, POPE, strangulation

INTRODUCTION:

Post obstructive pulmonary edema (POPE), also known as 'Negative pressure pulmonary edema' (NPPE) is a rare form of non-cardiogenic pulmonary edema. It generally manifests as potentially life threatening fulminant pulmonary edema that becomes apparent within seconds to minutes following acute upper airway obstruction (UAO) or relief of chronic UAO. Majority of POPE cases have been recognized postoperatively by anesthetists as a consequence of laryngospasm.[1] Other reported causes of POPE syndrome are croup, epiglottitis, mass effect secondary to tumor, choking,[2] strangulation and interrupted hanging.[3,4,5]

The association between UAO and pulmonary edema was described for the first time in animal experiments on dogs by Moore and Binger (1927),[6] in children by Capatanio and Kirkpatrick (1973)[7] and in adults by CE Oswalt et al (1977).[2] Very few cases have been published of POPE following strangulation.

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CASE REPORT:

A 14 year old boy was brought in altered sensorium to emergency department by his relatives with alleged history of accidental strangulation while playing on a swing made from a *saree*. He was freed from the *saree* within minutes and rushed to our hospital within ½ hour of the incidence. On admission, he was very irritable with decerebrate posturing on painful stimuli. Blood tinged froth was coming out of his mouth and a ligature mark was noted around his neck (Figure 1). His vital signs revealed pulse rate 146/minute, blood pressure 80/60 mmHg, respiratory rate 44/minute, Oxygen saturation (SpO_2) 60% on room air which increased to 70% on 10 litres Oxygen/minute delivered by facemask. His pupils were semi-dilated and sluggishly reacting to light. Chest auscultation revealed bilateral coarse crepitations. He was immediately sedated with intravenous Midazolam, intubated and put on ventilator support with synchronized intermittent mandatory ventilation (SIMV) mode initially with tidal volume 350 ml, FiO_2 100%, positive end expiratory pressure (PEEP) of 8 which was later increased to 10. Subsequently, Propofol infusion was

added to prevent patient fighting with ventilator and mode changed to intermittent positive pressure ventilation (IPPV). He required frequent endotracheal tube suctioning to clear his airways for initial 1 hour; more than 400 ml of blood stained frothy secretions were suctioned (Figure 2). His fundus examination was normal. Electrocardiogram showed sinus tachycardia. Laboratory tests for complete blood count, renal functions, liver functions, electrolytes, and urine routine examination were normal. Chest radiograph revealed bilateral fluffy opacities suggestive of pulmonary edema (Figure 3). Arterial blood gas (ABG) analysis done after putting patient on ventilator at FiO_2 of 100% revealed pH of 7.241, PaO_2 of 78.7 mmHg, $PaCO_2$ of 49.2 mmHg and HCO_3^- of 22.3mmol/L, suggestive of hypoxemia with acute respiratory acidosis with metabolic acidosis. Considering the decerebrate posturing and pulmonary edema with PaO_2/FiO_2 ratio of < 100, a provisional diagnosis of 'Hypoxic encephalopathy with acute respiratory distress syndrome (ARDS)' was made. He was shifted to ICU and treated with intravenous diuretic, cerebral decongestants (Furosemide, Mannitol 20%) and Dexamethasone along with antibiotic and supportive care of unconscious patient. SpO_2 improved gradually to >90% over next 6 hours and repeat ABG showed pH of 7.383, PaO_2 of 110.8 mmHg, $PaCO_2$ of 44.2 mmHg and HCO_3^- of 23.8 mmol/L. His lungs were clear of crepitations by 24 hours. After 1½ days of admission, FiO_2 was slowly tapered to 40% and Propofol infusion was tapered and stopped in next 24 hours. Ventilator mode was changed to SIMV (F-14, TV – 350 ml, FiO_2 – 35%) and

Figure 1: Arrow showing the ligature mark on neck.

Figure2: BloodStainedEndotracheal Secretions

Figure 3: Bedside Chest X-Ray showing pulmonary edema (on admission).

PEEP reduced to 5. At 2½ days of admission, Midazolam was also tapered and discontinued after which his consciousness started improving though he remained a bit irritable. His vitals were stable with pulse rate 90–106/minute, BP 100-110/60-70 mmHg, respiration rate of 18-22/minute maintaining SpO_2 of >95% at FiO_2 of 35%. As he was still disoriented, a T-piece trial was given; somehow patient self extubated in 4 hours.

Subsequently, his SpO_2 was monitored and managed with Oxygen by nasal prong at 2 litres/minute. Repeat X-ray chest done on 4th day showed complete resolution of pulmonary edema (Figure 4). By the end of 4th day, Oxygen was also

stopped and he was fully oriented to place and person but had amnesia for the strangulation event. His Echocardiography was normal. He was monitored for next 3 days and discharged with full recovery on 7th day of hospitalization.

DISCUSSION:

Though this patient was admitted with a provisional diagnosis of Hypoxic encephalopathy with ARDS, a possibility of POPE syndrome was suspected by the corresponding author based on his

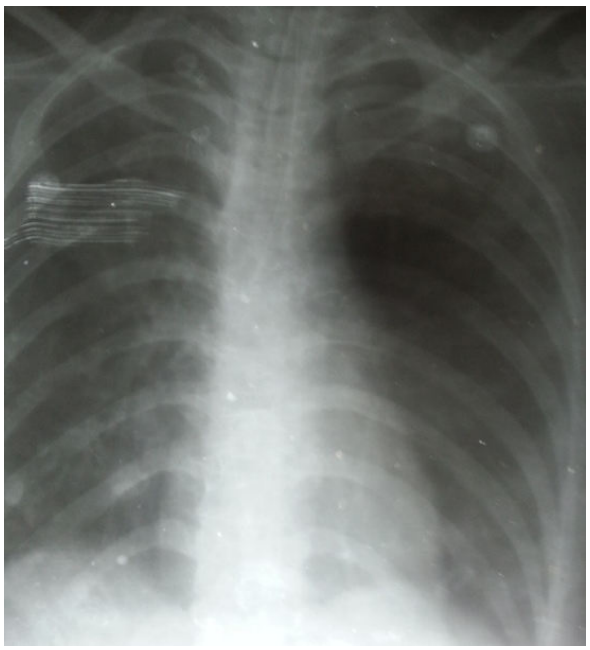

Figure 4: Chest X-Ray on 4th day of treatment (complete resolution of pulmonary edema).

past experience and review of patient's history. Rapid recovery of pulmonary edema within 2 days supported this diagnosis too. Pulmonary edema developing after non-fatal strangulation has been reported very infrequently; most probably due to a poor survival rate amongst victims of strangulation. Recommended management of POPE/NPPE includes use of Continuous Positive Airway Pressure (CPAP) or Positive End Expiratory Pressure (PEEP) in patients requiring mechanical ventilation ± diuretics. Clinical and radiographic improvement has been reported in 12 to 24 hours in majority of cases[1]. Present case was also managed with standard recommendations.

POPE may occur within minutes to upto 6 hours in majority of patients, following either the development or relief of acute severe upper airway obstruction. However, delayed onset beyond 12 hours after the precipitating event has also been reported.[4] Therefore, all patients should be observed and monitored for development of pulmonary edema after suffering from acute severe upper airway obstruction.[8] Two subtypes of POPE/NPPE have been described-

POPE/NPPE Type I- develops following acute upper airway obstruction.[2] Post-extubation laryngospasm is the most common cause. It may also be caused by hanging, strangulation, upper airway tumors, chocking due to foreign body, migration of Foley`s catheter balloon used to tamponade the nose in epistaxis and near drowning. Present case falls under this category.

POPE/NPPE Type II– develops following relief of upper airway obstruction - post operative patients with big tonsils, hypertrophic adenoids and hypertrophic redundant uvula.[9]

The pathophysiology for development of pulmonary edema in POPE type I is attributed to many factors -

- As patient tries hard to breathe in against closed upper airway, it generates marked negative intrathoracic pressure. This reduces interstitial pressure causing shift of fluid from pulmonary capillaries to interstitium and alveoli.[10]
- Hypoxemia as a result of UAO leads to peripheral vasoconstriction causing increased venous return to right heart and thus increased pulmonary circulation with increase in pulmonary capillary pressure favouring fluid shift to low-pressured alveolar spaces.
- Increased negative intrathoracic pressure [−50 to −100 cmH_2O] increases venous return to right heart leading to elevation of ventricular end-diastolic volumes; thus the left ventricular end-diastolic pressures get elevated contributing to formation of pulmonary edema.[11,12]
- Capillary and endothelial damage may result from shearing forces generated during forced inspiration against a closed airway leading to diffuse alveolar injury and diffuse alveolar hemorrhage.[13]

Pulmonary edema in POPE type II is attributed to sudden removal of auto positive end expiratory pressure (auto PEEP) and thus a sudden decrease in chronically elevated lung pressures. This

generates a negative intrapulmonary pressure causing transudation of fluid in lung interstitium.[5,9]

CONCLUSION:

POPE/NPPE is often undiagnosed or misdiagnosed; hence an under-reported life threatening medical emergency. Anaesthetists and critical care specialists encounter POPE mainly due to post-extubation laryngospasm. POPE secondary to strangulation is much lesser known condition and acute pulmonary edema in these cases can be life-threatening requiring mechanical ventilation with high PEEP to maintain oxygenation in addition to supportive treatment. Diagnosis of POPE syndrome is based primarily on clinical presentation-history suggestive of UAO followed by rapid development of agitation, respiratory distress, declining SpO_2, tachypnoea, tachycardia, bilateral crepitations $\pm$ rhonchi over chest with pink frothy sputum and chest radiograph suggestive of pulmonary edema. With early diagnosis and intervention, majority will recover completely within 24-48 hours. There is a need to increase awareness about this entity to all clinicians specially those working in emergency and critical care units and also to differentiate it from ARDS.

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Case Report

Endodontic Management of Radix Entomolaris in Mandibular Second Molar - A Case Report and Ex-Vivo Evaluation

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ABSTRACT

Radix Entomolaris (additional lingual root) is commonly found in mandibular first and third molars. However, its prevalence in second molars is only 23% in Indian population. A thorough knowledge of root canal anatomy and its variations ismandatory for a clinician to successfully treat such cases.The aim of this paper is to report a mandibular second molar featuring three roots, which is a rare clinical entity.Also, an ex vivo evaluation ofextracted second molars exhibiting radix entomolaris was done to have an insight into theirexternal morphology and modifications required in the access cavity preparation to locate the extra canal.

KEY WORDS: mandibular second molar, radixentomolaris, classification, variation

INTRODUCTION:

Thesuccess in root canal treatmentdepends on thorough cleaning and shaping of root canals followed by a three-dimensional root filling with a hermetic seal. Therefore, it is mandatory for the clinician to have thorough knowledge of root canal anatomy and its variations.[1]

It is commonly acknowledged that both deciduous and permanent mandibular molars display several anatomical variations. The majority of mandibular second molars (96%) are two-rooted with two mesial and one distal canal.[2] However, variations existi.e. one root in 9.3% and three roots in 4.3%.[3] An additional third root, first mentioned in the literature by Carabelli, is called Radix Entomolaris (RE).RE is found on the first, second and third mandibular molars,is located distolingually and occurs least frequently in the second molar.[4] The frequency of prevalence of radix entomolaris in second molar in Indian population is .23%.[6] The identification and external morphology of these root complexes, containing a lingual or buccal supernumerary root, has been described in the literature.[5]

The aim of this paper is to report a case of Radix Entomolaris in mandibularsecond molar with a simultaneous ex vivo evaluation.

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CASE REPORT:

A 25 -year-old female patient was referred to the Department of Conservative Dentistry and Endodontics, with the chief complaint of continuous dull pain in lower right tooth region. An intraoral and radiographic examination revealed a deep carious lesionapproaching pulp in the right mandibular second molarwith (Figure 1).

After anaesthetizing the tooth, endodontic access cavity preparation was done using an Endo Access bur (DentsplyMaillefer, Ballaigues, Switzerland) and mesiobuccal, mesiolingual and distobuccalorifices were located with DG 16 endodontic explorer(Hu-Friedy, Chicago, IL). On inspection of the pulp chamber floor with operating loupes,a dark line was observed between the distal canal orifice and the distolingual corner of the pulp chamber floor. At this corner, overlying dentin was removed with a diamond bur with a noncutting tip (Diamendo, Dentsply,Maillefer) and a second distal canal orifice was detected(Figure 5-a). Canal patency

was established using a #10 K file.Radiographic length determination showed a separate distal root, identified as a RE (radix entomolaris) and working length was determined by intraoral periapical radiograph which wasverified by electronic apex locator (PropexII; Dentsply, Maillefer) (Figure 2). Root canal instrumentation was performed with ProTaper Ni-Ti rotary files (Dentsply Maillefer, Tulsa, OK) using a crown-down technique upto F1 size for the mesial canals and F2 size for the distal canals. After each instrumentation, the root canals were disinfected with 3% sodium hypochlorite solution and saline simultaneously. After completion of biomechanical preparation, a closed dressing was given. On recall after a week, the patient was asymptomatic. Root canal obturation was done with corresponding protapergutta-perchacones (Dentsply Maillefer) using AH Plus resin sealer (Dentsply, Maillefer). A postoperative radiograph was taken and subsequently

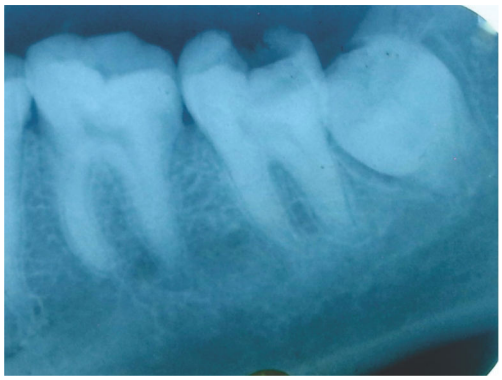

Figure 1: Preoperative radiograph of Radix in 47

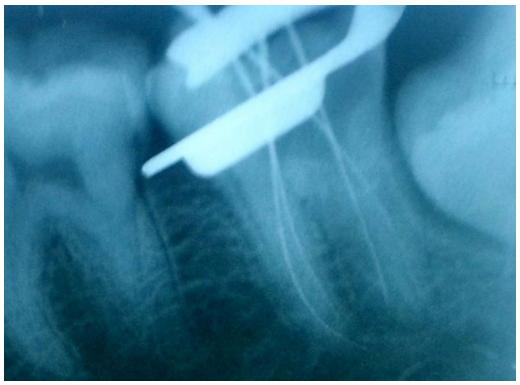

Figure 2: Working length radiograph

the access cavity was sealed with permanent coronal restoration (Figure 3).

EX VIVO EVALUATION:

Four extracted second molars exhibiting Radix Entomolaris were evaluated for morphology. Three out of four had extra root emerging from the

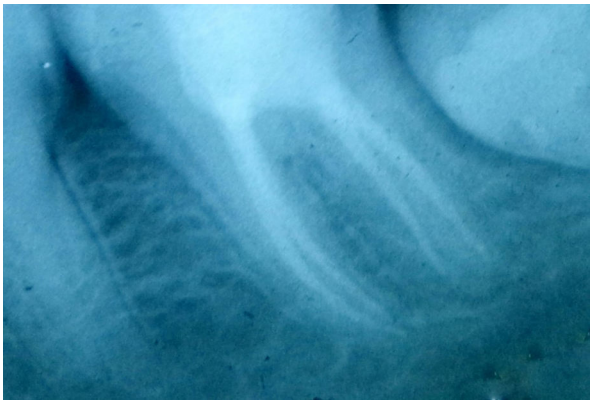

Figure 3: Post obturation radiograph.

Figure 4: Ex -Vivo evaluation of radix in second molars

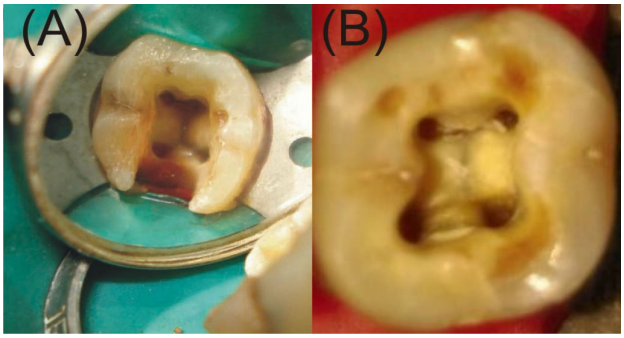

Figure 5: Access cavity modifications in radix (a) intra-oral (b) ex-vivo

lingual aspect of the root midway between the mesial and distal roots (Type AC) and one conformed to Type C. The roots were of variable length and tapered apically (Figure 4).

Access cavity was prepared on all the extracted molars which had to be modified to locate the supplemental orifice which was mostly located in the disto-lingual position nearing the external wall with a greater inter-orifice distance than usual. The dentinal map proved a useful guide to locate the extra canal (Figure 5-b).

DISCUSSION:

Etiology:

The exact cause of radix entomolaris is still not known. Some authors say that it may be due to disturbance during odontogenesis or may be dueto an atavistic gene.[1]

Prevalence:

A supernumerary root can be found on the first, second and third mandibular molars, occurring least frequently on the second molar.A study evaluating the canal anatomy of 149 extracted mandibular second molars using clearing technique showed that 22% of the mandibular second molars had single roots, 76% had two roots and 2% had three roots.[7]Another study reported two cases of three rooted mandibular second molars, with one mesial and two distal roots.[8] A further study evaluating racial variations of the mandibular second molar showed that the incidence of three rooted mandibular second molars was 2.8% in Mongoloid patients, 1.8% patients of Negro origin and 1.7% in Caucasian patients.[9] A prevalence of 0.23% bilateral three-rooted mandibular second molars has been seen in Indian population.[6]

Diagnosis:

Identification of an additional root can be facilitated by periodontal probing. Presence of Radix Entomolaris can also be indicated by presence ofan extra cusp (tuberculumparamolare) or more prominent occlusal distal or distolingual lobe, in combination with a cervical prominence or convexity.To achieve a correct diagnosis, a minimum of two diagnostic radiographs are necessary using buccal object rule.

An avid clinician should always be keen to explore the possibility of additional root canals whenever in doubt.[10] Diagnostic aids such as CBCT, Dentascan, multiple preoperative radiographs, examination of the pulp chamber floor with a sharp explorer, troughing of the grooves with ultrasonic tips, staining the chamber floor with 1% methylene blue dye, performing the sodium hypochlorite "champagne bubble test," and visualizing canal bleeding points are all important aids in locating additional root canal orifices in such cases.[11]

A classification of Radix Entomolaris has been given by Carlsen O andAlexandersen V based on the location of the cervical part of RE which were divided into A,B,C,AC. Type A& B refers to a distally located cervical part. Type C refers to a mesially located cervical part. Type AC refers to the location of the cervical part in the central location in between the mesial and distal components.[1]

De Moore RJ et al had given another classification based on the curvature of RE variants in the buccolingual direction. They are Type I referred to straight root canals , Type II referred to as having a curvature at the entrance of theorifice.Type III refers to RE with two curvatures, one at the coronal level and the other at the middle third.[3]

Clinical implication:

Access cavity preparation should be modified usually from a triangular to a trapezoidal shape. The modification should be done following the dentinal map. Advanced diagnostic aids such as magnifying loupes or surgical microscope help in the better identification and visualization of all the canals.

Using various instruments like endodontic explorer, path finder, DG 16 probe and micro-opener and the use of sodium hypochlorite forChampagne effect would help in identification of anadditional orifice.

A severe root inclination or canal curvature, particularly in theapical third of the root (as in a type III RE), can cause shaping aberrationssuch as straightening of the root canal or a ledge, resulting in root canaltransportation and loss of working length. The use of flexiblenickel-titanium rotary files allow a more centered preparation shapewith restricted enlargement of the coronal canal third and orifice relocation.

While treating RE, the knowledge of mean inter-orifice distances might help dentists to locate orifices and to achieve successful endodontic treatment. Tu *et al*. has reported that mean inter-orifice distances from the disto-lingual canal to the disto-buccal, mesio-buccal and mesio-lingual canals of the permanent three-rooted mandibular molars were 2.7, 4.4 and 3.5 mm, respectively.[9]

CONCLUSION:

Understanding the variations in the root canal morphology is important for the successful outcome after conventional root canal therapy. A case of radix entomolaris may be challenging but can be easily diagnosed by a careful evaluation of pre-operative radiographswhen taken at different angulations. A knowledge of such deviation and schematic treatment approach becomes mandatory for long term success in such cases.

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Extramedullary Plasmacytoma: A Diagnostic Challenge

Case Report

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ABSTRACT

Myeloma is a cancer of plasma cells. Myeloma. Multiple Myeloma involves skeletal system at multiple sites while solitary myeloma is a single focus of proliferation of plasma cells. Solitary myeloma can be present in bone or may have a soft tissue origin. Solitary myeloma of soft tissues is known as extramedullary plasmacytoma. Just as lymphomas or leukemias, multiple myeloma is a very common type of blood cancer with the incidence of one in every one hundred and fifty persons. But in contrast to this solitary myeloma and that too of soft tissue origin is a very rare clinical manifestation with an incidence of one in a million. Here is a case presentation of a soft tissue solitary myeloma or extramedullary plasmacytoma.

KEY WORDS: extramedullary plasmacytoma, myeloma, plasma cells

INTRODUCTION:

Extramedullary plasmacytomas are rare tumours of malignant origin. The term myeloma was first coined by Ruztky in 1873 and the earliest evidence of myeloma was found in Egypt. The first case of solitary myeloma was reported by Stout and Kennedy in 1949. [1] Multiple myeloma is a plasma cell neoplasm involving skeletal system at multiple sites, while solitary myeloma in contrast to multiple myeloma is a single focus of proliferation of plasma cells. Solitary myeloma may involve a particular bone known as solitary myeloma of bone or may occur exclusively in soft tissues called as extramedullary plasmacytoma. Solitary myeloma of bone usually involves long and flat bones like vertebrae, spine or the bones of skull and its clinical features include pain and swelling in the region of the involved bones. Extramedullary plasmacytoma is a very rare clinical manifestation and amongt the few cases reported most of them were present in Nasopharynx, Nasal mucosa, gingiva and Subcutaneous tissues involving head and neck.

This disease usually manifests itself in the form of a localized soft tissue swelling which is extremely painful in nature. These plasmacytomas may invade the adjacent bones and metastasize to regional lymph nodes. Research studies show that if not diagnosed and treated at the right time, they may transform into multiple myeloma.[1,2]

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CASE REPORT:

A 69 year old female patient reported to the Dental OPD with a complaint of swelling on the right side of the jaw. She noticed the swelling two months back. Initially, it was about the size of a lemon but then it suddenly increased in size and within a short period of two months, transformed into a massive swelling of 3x4 inches. The swelling was also accompanied by burning sensation over the affected area. Patient was not able to sleep due to throbbing pain and burning sensation. There were no complaints of bone pain, renal failure or any other systemic manifestations.

On examination it was found that a swelling was present on the right side of the mandible which extended from the angle of mandible to a line dropped to the angle of mouth posterolaterally, superiorly from a line joining the angle of mouth to the lobule of ear and upto the middle third of neck, inferiorly. The swelling was localized in nature, soft in consistency and showed no signs of inflammation. The regional lymph nodes were not enlarged.

On intraoral examination the patient was

found to be edentulous and interestingly, there were no signs showing intraoral origin of the swelling. On the basis of above mentioned complaints and examination a biopsy was performed and the results of the histopathological examination showed abundant amount of plasma cells. Sheaths of plasma cells were present with varying degree of differentiation along with a few lymphocytes and polymorphonuclear leukocytes – which is the characteristic feature of myeloma or plasmacytoma.

Figure 1: Inframandibular swelling of 3 x4 inches

Figure 2: Evidence of intraoral origin of swelling.

DIAGNOSIS:

Biopsy reports showed cells that are round or ovoid in shape with their nuclei eccentrically placed. Their nuclei showed clumping of the chromatin material exhibiting a typical cartwheel appearance and a perinuclear halo indicating the presence of Myeloma. Radiographic examination of skull and mandible did not reveal the presence of lytic or punched out lesions and there was no evidence of bone destruction. Lytic or punched out lesions are essentially present in multiple myeloma and solitary myeloma of bone, but absent in extramedullary plasmacytoma.

Patient was advised for plasma electrophoresis and the results of serum electropho-resis did not show hypergammaglobuline-mia or presence of abnormal M proteins.

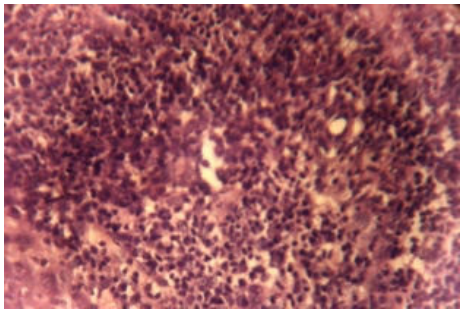

Figure 3: Plasma cells in electron microscope.

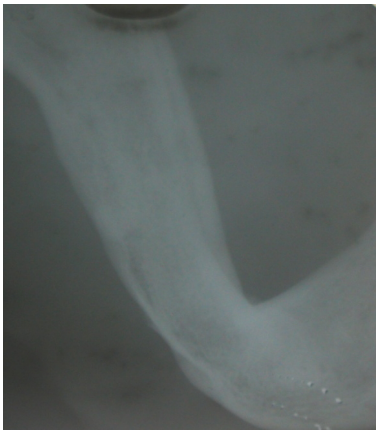

Figure 4: Radiograph of mandible.

Figure 5: Radiograph of skull.

Hypergammaglobulinemia is always present in multiple myeloma, but absent in both the types solitary myeloma i.e. solitary myeloma of bone and extramedullary plasmacytoma. Excessive gammaglo bulins produced by malignant plasma cells can easily be identified in serum electrophoresis and act as a vital key in the diagnosis of multiple myeloma and more importantly in the differential diagnosis of solitary myeloma from multiple myeloma.

Since the reports of serum electrophoresis and radiographic examination were normal and since there were no complaints of bone pain, renal failure, anemia or any other systemic manifestation the possibility of multiple myeloma was completely ruled out. However based on biopsy reports, it was diagnosed as a case of solitary myeloma and absence of radiographic findings confirmed it to be extramedullary plasmacytoma affecting mandibular and inframand ibular region.

DISCUSSION:

Solitary myeloma remains undiagnosed in most of the cases and later on transforms into multiple myeloma.[3] A case of extramedullary plasmacytoma of oesophagus has been reported in a 58 year old man. The chief complaints being dysphagia for solid foods.[2] Two cases of extramedullary plasmacytoma of rectum and their treatment by radiotherapy have been reported. First patient was relieved in 36 months while the other in 3 months.[4] Similarly another study analysed the clinical features and response to treatment of 35 patients with extramedullary plasmacytoma. Median age was 49 years. [5]

CONCLUSION:

Solitary myeloma is a rare clinical manifestation with the incidence of 1 in a million. It can be found, during intensive surveillance, in significant quantum amongst the dental outpatients. However, many of these are missed due to lack of thorough clinical examination and tedious diagnostic requirements and finally emerge out as multiple myeloma. Virtually rare occurrence, exceptionally different presentation, intensively thorough course of investigation and probability of malignant transformation make solitary myeloma a crucial ailment.

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Case Report

Functio-Esthetic Rehabilitation in Severe Hypodontia: an Interdisciplinary Approach

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ABSTRACT

Full mouth rehabilitation in cases of severe hypodontia remains a clinical challenge and requires a meticulous interdisciplinary approach to obtain desirable results. Early diagnosis, and comprehensive treatment planning with good coordination and timing of the individual treatment phases are integral for successful treatment outcome. The present article reports a case of severe hypodontia in a 19-year old female patient with 11 permanent teeth missing. Treatment began with comprehensive orthodontic therapy followed by restoration of the edentulous spans by fixed dental prosthesis to achieve functional and aesthetic satisfaction of the patient.

KEY WORDS: fixed dental prosthesis, interdisciplinary, severe hypodontia

INTRODUCTION:

Hypodontia is defined as the developmental absence of one tooth or more. It may be present with varying degrees of severity viz. mild, moderate and severe. Severe hypodontia is developmental or congenital condition with absence of six or more teeth. Absence of fewer than normal teeth in the presence of systemic manifestations is often termed Oligodontia.[1] Severe hypodontia of the permanent dentition has prevalence of 0.3% of the population.[2]

Treatment in general depends on severity of hypodontia and ranges from single restorations to surgery, to improve appearance, mastication, and speech, associated with lifelong maintenance. [3] The interdisciplinary intervention involving a committed team to achieve an optimal outcome for the patient is one of the key factors, for the successful treatment of patients with hypodontia.[4] This report describes a interdisciplinary treatment approach for a 19 years old female patient with severe hypodontia exhibiting congenital absence of 11 permanent teeth.

CASE REPORT:

Pre-treatment evaluation : A 19 years old female patient presented with the complaint of multiple missing teeth and unpleasant smile. Family history did not reveal any hereditary trait and no systemic manifestations were found.

Extra oral examination revealed a flat profile having facial symmetry. Intra-oral examination revealed absence of 11 permanent teeth. The missing teeth were 12, 13, 14, 22, 23, 27, 31, 32, 35, 41, and 42. Over retained deciduous 53, 63 and 75 were found. Diastema of about 3mm was present between 11 & 21(Figure 1).

Diagnostic records included an Orthopantomogram (Figure 2), a lateral cephalogram, and study models. The patient was explained all the treatment alternatives like orthodontic space management, osseointegrated implant supported prosthesis and conventional fixed prosthesis using a variety of materials. After thorough evaluation and discussion, treatment plan was finalized, explained to the patient and consent obtained.

Treatment phases:

1. Pre-restorative Orthodontics: After extraction of 53, 63 and 75, comprehensive Fixed Orthodontic treatment was done with the help of O22 preadjusted edge-wise appliance (PEA). Orthodontic treatment was initiated with the alignment of teeth followed by diastema closure along with intrusion of maxillary central incisors (Figure 3).

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Figure 1: Pre-operative Images :Maxillary occlusal, Mandibular occlusal and Frontal view.

Figure 2: Pre-operative Radiograph (Orthopantamograph).

2. Restoration with a removable partial denture: After completion of orthodontic treatment, again diagnostic impressions were made to evaluate the occlusion. Second molars were in adequate intercuspation thus used for establishing final functional occlusion. Patient was then given interim acrylic removable partial dentures for diagnostic vertical space assessment and to check aesthetic outcome before placement of definitive prosthesis.
3. Restoration with a tooth-supported fixed partial dental prosthesis:
   Tooth preparations were done for 33 & 43 and 35 & 37 and for maxillary teeth i.e. 11 & 15 and 21 & 24 with heavy chamfer finish line. The provisional FDP restorations were delivered according to visibility and aesthetic. Cementation of provisional restorations was done with Non Eugenol temporary cement.
   Maxillary and mandibular elastomeric impressions were made with two step double mix technique with polyvinyl siloxane impression material after gingival retraction.
   Interocclusal records were obtained with silicone bite registration material using vertical stop present in right second molar region as guide. The working casts were mounted with ear-piece facebow record on Whipmix semi adjustable articulator and wax try-in was done. The Porcelain fused to metal prosthesis was designed to develop Group function occlusion for even distribution of occlusal loads. The prosthesis was cemented with type I Glass Ionomer Cement (GC Fuji I) (Figure 4).
4. Follow up- Oral hygiene instructions were given to the patient and patient was recalled after one week of cementation. Patient expressed satisfaction and confidence in the treatment delivered. Patient was called upon for recall visits every six months.

DISCUSSION:

Hypodontia can be both non-syndromic, where it is an independent congenital oral trait; or syndromic, where it is acquired as part of a specific disease.[5] Non-syndromic Hypodontia is more common than syndromic form.[6] In present case, no systemic clinical signs and symptoms were detected. So, the probable diagnosis was severe hypodontia-isolated/nonsyndromic. Restorative treatment generally requires interdisciplinary teamwork, including an Orthodontist and a Prosthodontist. Pre-prosthetic orthodontic therapy is required for proper positioning of the teeth to achieve improved biomechanical, functional, and esthetic outcome.[7]

Considering the oral rehabilitation of 11 missing permanent teeth, the present patient opted for fixed dental prosthesis over implant-supported restorations because of time and cost constraints. Conventional FDP have been a popular treatment modality, because of predictable and successful results. Prosthodontic rehabilitation via dental implants is a successful treatment, although being difficult occasionally because the congenital absence of teeth may result in lack of sufficient alveolar bone for implant placement.[8] It may dictate the use of a narrow platform implant and if vertical height is poor, it may lead to unfavorable crown and implant length ratio.[9]

Figure 3. After orthodontic therapy: Maxillary occlusal, Mandibular occlusal and Frontal view.

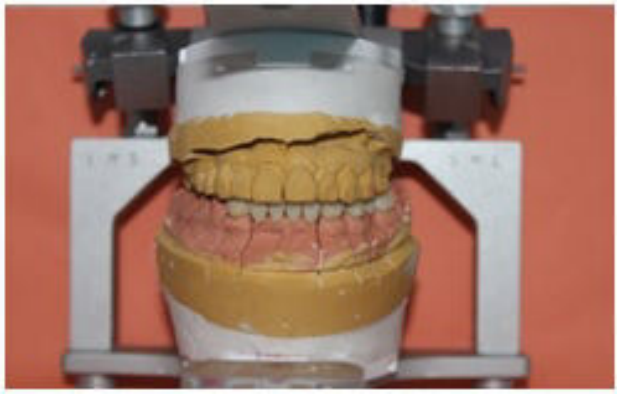

Figure 4: Mounted casts on Whipmix articulator

Figure 5: Post-operative Image (After Prosthetic rehabilitation).

CONCLUSION:

Treatment of hypodontia is challenging but a coordinated interdisciplinary approach that goes long way in restoring or building up patient's self confidence and social outlook. With technological advancements, treatment options for such conditions have dramatically increased but we must understand that such patients are special with special treatment needs. Hence, it should be dealt on an individual basis for the most successful clinical outcome.

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Case Report

A Rare Endocrine Disorder Presenting as Recurrent Seizures

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ABSTRACT

Pseudohypoparathyroidism (PHP) refers to a group of distinct inherited disorders.Patients are characterised by signs and symptoms of hypocalcaemia in association with distinctive skeletal and develpomental defects. Pseudohypoparathyroidism is an uncommon sporadic or inherited genetic disorder subdivided into several distinct entities (type Ia, Ib, Ic, type II).The present case highlights the difficulty in making diagnosis as the patient completely lacked phenotypic features related to PHP. We stress the importance of a complete biochemical investigation of the calcium phosphate metabolism to recognize typical biochemical alterations associated with this condition [hypocalcaemia, hyperphosphataemia with increased phosphate tubular reabsorption and elevated parathormone(PTH) levels]. As this is an entirely treatable condition, a high index of suspicion for pseudo hypoparathyrodism with hypocalcemic seizures should be maintained even in otherwise asymptomatic adults.

KEY WORDS: pseudohypoparathyroidism,seizures,hypocalcaemia,parathormone

INTRODUCTION:

Pseudohypoparathyroidism is a heterogeneous group ofdisorders characterised by hypocalcaemia, hyperphosphataemia, increased serum concentration of parathormone, and insensitivity to the biological activity of parathormone. Patients may present with an unusual constellation of developmental and skeletal defects collectively termed Albright's hereditary osteodystrophy. The disease can present at any age. Patients may remain asymptomatic or may demonstrate characteristic physical features with or without signs and symptoms of hypocalcaemia. This case report, describes the spectrum of manifestations of this rare condition presenting as seizures with absence of peculiar features leading to delayed diagnosis and its management. It report also highlights the importance of biochemical investigations other than clinical features for diagnosing PHP.

CASE REPORT:

A 18 year old male, came to the emergency department with complaints of recurrent seizure like episodes since last 4 days. On detailed history, it was discovered that he had a past history of recurrent seizures for the last 5 years inspite of being on multiple antiepileptic medications including phenytoin sodium and sodium valproate. During the seizure like episodes, patient had stiffness of limbs, uprolling of eyeballs with rubbing of chin over hard surface which caused injury over chin. Despite taking antiepileptics, his seizure like episodes could not be controlled. This happened for two times with the patient. The seizure frequency had increased considerably to one episode daily in the last 4 days, and he would have at least 3-4 episodes in a month before the present episode. Patient also revealed that his mother also had stiffness of limbs.

General physical examination was relatively normal.There was no carpopedal spasm or any other signs of tetany like Chvostek's or Trousseau's sign. Fundoscopy was normal. He had no dysmorphic features.

Investigations revealed that his serum calcium was 5.6mg/dl (N 8.4-10.2 mg/dl), PTH 528 pg/ml (N 14 - 72 pg/ml), phosphate 8.2 mg/dl (N 2.44.40 mg %), magnesium 1.2 mg% (1-1.4 mg %),

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Figure 1: Computerised tomography scan of the head.

Figure 2: Normal Xray of hands in AP view showing calcification of the basal ganglia.

with normal albumin, alkaline phosphatase, renal function test, normal hemoglobin and glucose level with normal sodium and potassium levels. His vitamin D level could not be done due to financial constraints. TLC and DLC levels were also normal.EEG study was normal.

CT scan revealed extensive bilateral basal ganglia calcification and gyriform calcification in frontal lobe,left temporal and right occipital lobe (Figure 1 and 2). With these investigations, after ruling out other causes, possibility of pseudohypoparathyrodism was suggested. The patient was treated with intravenous calcium gluconate, oral calcium carbonate (CaCo3) 500 mg thrice a day and alfacalcidol 0.5 mcg daily. Patient was discharged and on repeat follow up, his serum calcium level increased to 8.5 mg/dl with no further complains of seizure like episode or stiffness in limbs.

DISCUSSION:

Pseudohypoparathyroidism (PHP) refers to a group of distinct inherited disorders characterised by PTH resistance. Patients are characterised by signs and symptoms of hypocalcaemia in association with distinctive skeletal and develpomental defects. Due to biochemical similarities with hypoparathyroidism but associated with high levels of PTH, it was called pseudohypoparathyroidism (PHP).

Pseudohypoparathyroidism is subdivided into several distinct entities (type Ia, Ib, Ic, type II). The classification is based on signs of ineffective PTH action (low calcium and high phosphate),urinary cyclic adenosine monophosphate (AMP) response to exogenous PTH, the presence or absence of Albrights hereditary osteodystrophy (AHO) and assays to measure the concentration of the GS alpha subunit of the adenylate cyclase enzyme.[1-2]

PHP Type Ia individuals show evidence for AHO with resistance to PTH and other hormones that stimulate adenyl cyclase in their target tissues, such as thyroid stimulating hormone (TSH), gonadotropins and growth hormone releasing hormone (GHRH). PHP Type Ia clinical features collectively termed AHO include short stature, rounded face, brachydactyly, brachymetacarpia (short fourth and fifth metacarpals), centripetal obesity, heterotopic calcifications, and in some cases, mental or developmental delay. Amorphous deposits of calcium and phosphate are found in basal ganglia in one half of patients.These individuals have hypocalcemia, hyperphosphatemia, with deficient urinary cyclic AMP response to administration of exogenous PTH and GS alpha subunit deficiency.[1-2] 50% activity of GS alpha subunit is found in these individuals.

Type Ib PHP individuals shows resistance to

PTH mainly in the renal tissue and in a few others tissues such as the thyroid, but without features of AHO with normal GS alpha subunit deficiency.[1,3]

Type Ic PHP which is rarest subtype shows resistance to PTH and other hormones in face of normal GS alpha activity with AHO features.[1]

PHP type II individuals have hypocalcaemia, hyperphosphataemia and increased serum PTH, but they lack the physical features associated with AHO.[4]

Our patient presented with intractable epilepsy, and during the work up to elucidate the etiology of his recurrent seizures, he was found to have PHP. The cause of the patient's seizure activity was found to be multifactorial. The causes included direct and indirect effects of PHP. The PHP caused extensive calcifications of the basal ganglia and cerebral cortex. Calcification of the basal ganglia is a rare phenomenon, and approximately 70% to 80% of cases are caused by a disorder of calcium metabolism, such as hypoparathyroidism and PHP.[5] Other pathologic causes of symmetric bilateral basal ganglia calcification include Fahr's syndrome, Down syndrome, Cockayne syndrome, and tuberous sclerosis, but none of these syndromes present with the laboratory findings or physical features of AHO that are characteristic of PHP.[6] The presence of a metabolic cause for bilateral basal ganglion calcifications, such as hypocalcemia due to PHP Ia, effectively rules out the other aforementioned syndromes.

It has been suggested that vascular insufficiency in the extrapyramidal system causes this characteristic deposition of calcium in the basal ganglia, but there have been no data to definitely support this claim.[5,7] Approximately 50% of patients with PHP exhibit localized calcification of the basal ganglia.[8] Extensive calcification of the cerebral cortex extending beyond the basal ganglia, however, is a rare finding.[8] When detected on imaging studies, these findings result in a diverse clinical presentation, including seizures, mental deterioration, and Parkinsonism, although some patients may remain asymptomatic.[5] Our patient presented with extensive bilateral intracranial calcifications involving the basal ganglia and cerebral cortex, which may have contributed to intractable epilepsy.

Another factor shown to contribute to loss of seizure control is long-term antiepileptic therapy, particularly phenytoin, phenobarbital, and carbamazepine. These antiepileptic medications induce hepatic microsomal enzymes that convert 25-hydroxyvitamin D to inactive metabolites, resulting in low levels of vitamin D.[9] This leads to low levels of 1,25-dihydroxyvitamin D, impaired absorption of calcium from the intestine, and reduced mobilization of calcium from bone, further exacerbating hypocalcemia.[10] Laboratory results in these patients will show low serum levels of 25-hydroxyvitamin D, 1,25-dihydroxyvitamin D, and calcium. If a compliant patient on antiepileptic therapy presents with loss of seizure control, clinicians must consider the possibility of antiepileptic induced hypocalcemic seizures. In a patient with PHP who presents with loss of seizure control after previously being stable on antiepileptic therapy, an even further exacerbation of hypocalcemia may occur, resulting in intractable epilepsy. This was of much importance in our patient as he was started on anti epileptics five years back.

The aim of PHP therapy is to obtain an adequate calcium-phosphate control and to correct the multiple hormonal resistance, when present. Treatment includes the use of vitamin D active metabolites (alfacalcidol and calcitriol,20-50 ng/kg/day given in two doses) and calcium supplementation (intravenous calcium to correct symptomatic hypocalcaemia and then oral calcium administration according to individual response and dietary calcium intake). The goal is to maintain blood calcium between 2.2-2.7 mmol/l (= 8.8-10.8 mg/dl), urinary calcium excretion <4 mg/kg/day, and the urinary calcium/urinary creatinine ratio <0.2. Once the patient has demonstrated a satisfactory response,patient should undergo a biochemical (calcium, phosphorus, PTH, creatinine) and urinary (calcium and creatinine) examination every three months. A strict follow up is essential to adjust the therapeutic dosage and to preserve a difficult biochemical balance.

Competing Interests:

The authors declare that they have no competing interests.

Authors' Contributions: Rajesh Patel acquired and analyzed the clinical data, and drafted the manuscript. Raghav Singhal contributed to the interpretation of the data, revised, and finalized the manuscript. Vivek Saxena contributed to the analysis of the data and the drafting of the manuscript. Shaifali Bansal contributed on the clinical data acquisition, and the interpretation of patients' data. Sushil Jindal contributed on clinical data acquisition, supervised and revised the manuscript. All authors read and approved the final manuscript.

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Umblical Cord Cyst in Second Trimester of Pregnancy

Case Report

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ABSTRACT

The case presented here is a rare case of umbilical cord cyst detected in second trimester of pregnancy. Cystic masses of the umbilical cord are associated with fetal abdominal wall defects and chromosomal anomalies. 20% of umbilical cord cysts are associated with structural or chromosomal anomalies, especially trisomy 18 and 13. These are sometimes associated with increase risk of missed abortion. Their origin and significance must be considered for proper obstetric management.

KEY WORDS: anomaly scan, umbilical cord cyst, second trimester

INTRODUCTION:

The widespread use of high-resolution obstetric ultrasound has allowed accurate evaluation not only of the embryo and fetus, but also of the placenta and umbilical cord. Cysts of the umbilical cord have been identified using ultrasound at various stages of gestation. During the first trimester, the prevalence of umbilical cord cysts ranges from 0.4 to 3.4%. The prevalence of umbilical cord cysts in the second and third trimesters is unknown.[1] Umbilical cord cysts are usually classified as true cysts or pseudocysts. True cysts, derived from the embryological remnants of either the allantois or the omphalomesenteric duct, are located typically towards the fetal insertion of the cord and range from 4 to 60 mm in size.[2-4] Pseudocysts are more common than true cysts and can be located anywhere along the cord; they have no epithelial lining and represent localized edema and liquefaction of Wharton's jelly.[4] It is rarely possible to differentiate between true cysts and pseudocysts on ultrasound imaging. We have recently diagnosed umbilical cord cyst in second trimester of live pregnancy.

CASE REPORT:

A 23 yr old primigravida with history of amenorrhoea three and half months presented in Department of Radio Diagnosis, People's Medical College, Bhopal with complaint of pain in abdomen for 1 day and spotting P/V since 8 hours, along with passage of clots. Patient had history of coitus 3 days back.

She was an unbooked and uninvestigated patient. She had not undergone for any antenatal checkup and sonography. An emergency obstetric scan was done transabdominally. A single live intrauterine fetus of mean gestational age of 15weeks 5 days (Figure 1), with variable presentation was seen. Placenta was fundoanterior in upper uterine segment with grade I maturity. Two well defined thin wall cystic lesion measured 1.8x1.5 cm and 1.6x1 cm were seen arising from umbilical cord (Figure 2). No

Figure 1: Image showing intrauterine fetus of 15 wk 5 days revealing normal head and body.

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evidence of any colour flow on Doppler study (Figure 3) reconfirm the nature of lesion being non vascular cystic lesion. Patient was advised for target scan and quadruple test to rule out any associated congenital anomaly because umbilical cord cyst is associated with anueuploidy 18. Fetal karyotyping is advised to rule out aneuoploidy 18.

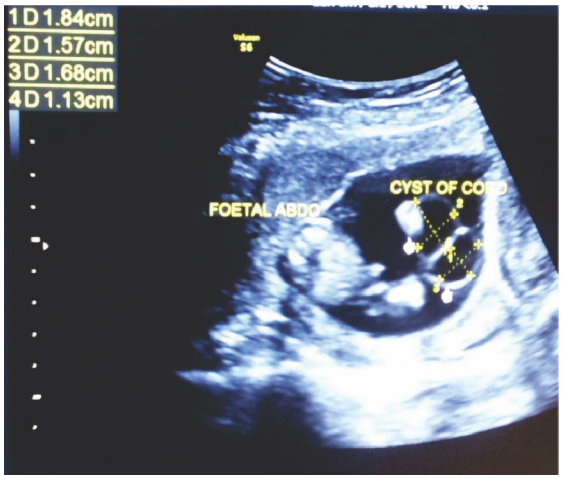

Figure 2: Image showing two well defined thin wall cystic lesion arising from umbilical cord.

Figure 3: Colour dopplor study reconfirm the etiology and origin of cyst.

DISCUSSION:

The prevalence of umbilical cord cysts in the second and third trimesters of pregnancy is unknown.[1] Details on affected pregnancies are based mainly on the findings of case reports, and thus the prognosis and outcome for fetus with this cord anomaly remain unclear. However, there are a few series reporting the outcome of pregnancies with umbilical cord cysts and these may shed some light on this issue. Umbilical cord cyst refers to any cystic lesion associated with the umbilical cord. Cord cysts can be defined as true or false cysts, and may occur on any location along the cord. These are located between the cord vessels and are irregular in shape. Cord cysts are found in 0.4% of pregnancies.[5]

True cysts are small remnants of the allantois (allantoid cysts) or the umbilical vesicle. Cysts have epithelial lining of flat or cuboidal uroepithelium and occur at the fetal or placental end of the cord. They grow up to several centimetres but more often range between 4 and 60 mm in size. True cysts can be associated with hydronephrosis, patent urachus[5], omphalocele[6] and Meckel diverticulum False cysts (pseudocysts) are more common. They come from liquefaction of Wharton jelly and may be as large as 6 cm. Compared with the true cysts, the pseudocysts do not have epithelial lining and are most commonly found at the fetal end of the cord. Pseudocysts may be associated with chromosomal anomalies, omphalocele, hemangiomas and patent urachus.[7] Regardless the type of the cord cysts, 20% of them are associated with structural or chromosomal anomalies, especially trisomies 18 and 13.

The cyst may be single (more common) or multiple. While single cysts in the first trimester are associated with favorable pregnancy outcome, the presence of multiple umbilical cord cysts, their persistence in the second and third trimester and their combination with other ultrasonographic abnormalities, is associated with increased risk of missed abortion. Prenatal diagnosis of the umbilical cord cysts is possible as early as in the first trimester, from 7th to 13th weeks of gestation. Color Doppler may be helpful in their differentiation from umbilical vessels. Differential diagnosis includes pseudocysts, omphalo-mesenteric duct cysts, vascular disorders, abdominal wall defects, bladder exstrophy, and urachal anomalies. Prenatal ultrasonographic differentiation between the true cysts and pseudocysts is not possible. The cysts tend to resolve by the end of the first trimester. Those that persist beyond 12 weeks and on to the second and third trimester, and the ones that are near the placental or fetal insertion, are more likely associated with chromosomal anomalies.[8] Thus when a cord cyst is encountered, a detailed sonographic survey of the fetus is advisable. Fetal karyotyping is indicated when other anomalies are found or when the cyst persists into the second trimester. If no other anomaly is found, the prognosis is excellent.

CONCLUSION:

To conclude, the apparent association with lethal chromosomal aneuploidy 18 and congenital anomalies, the finding of an isolated umbilical cord cystic mass should be further evaluated thoroughly in a tertiary fetal care centre. When either IUGR or other anomalies are found, karyotype testing should be recommended. When it remains an isolated finding, prognosis seems to be better. The risks and benefits of amniocentesis/cordocentesis, according to the findings and the week of gestation, should be considered carefully.

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